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PERMANENT ADDRESS:

5/505 Dandhal Tole,
Kathmandu,
NEPAL

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THE UNIVERSITY OF ALBERTA

ECONOMIC ANALYSIS OF RETAIL PRICES OF CEREAL GRAINS IN NEPAL

by

© PUSHPA R. MATHEMA

A THESIS

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AND RESEARCH IN PARTIAL FULFILMENT OF THE

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "Economic Analysis of Retail Prices of Cereal Grains in Nepal," submitted by Pushpa R. Mathema in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

.....

Supervisor

.....

.....

.....

.....

External Examiner

Date May 14, 1974.

DEDICATED

TO

MY LATE PARENTS

NIRAKAR AND KRISHNA MATHEMA

ABSTRACT

A study of behaviour of annual prices of cereal grains is very important in an emerging country like Nepal where grains have the predominant role in the development of the economy. In this study, the movements of retail prices of cereal grains, such as rice, maize and wheat in the different regions of Nepal are examined. Price instabilities are also examined. Multiple regression analyses are done to examine the relationships between grain prices and some important economic variables in the different regions of Nepal during the 1960's.

From 1961/62 to 1965/66, the annual rate of increase of prices was very high; from 1966/67, prices had a more fluctuating tendency. Prices of rice and maize were highest in the western Hills, and the lowest prices were recorded in the western Tarai. However, the western Tarai experienced the highest percentage increase in prices during 1961 to 1971.

The annual rice price instability was highest in the western Tarai. The annual rice price instability coefficient was 14 percent around the trend in this region. The wheat flour price instability coefficients were higher than the rice price instability coefficients in all regions except in the western Tarai. There were very high correlations between prices of rice in the Tarai and the Hills.

The important factors governing prices of rice in the Tarai were the volume of its production in these regions and the movements of prices of rice in India. The price of rice in the

Tarai was an important factor affecting price of wheat flour. In Nepal, the volume of wheat production was not an important factor influencing prices of wheat flour.

There was an explicit relationship between annual prices of rice in India, the Tarai and the Hills of Nepal. The price flexibility coefficient of annual retail prices of rice in the Tarai to changes in the annual wholesale price index of rice in India was 1.3. The responsiveness of annual retail prices of rice in the Hills to the changes in the retail prices in the Tarai were greater than 0.5; the eastern Hills rice price flexibility coefficient was 0.58 and the western Hills rice price flexibility coefficient was 0.96.

The annual rice price response to the changes in the volume of yearly production in the eastern Tarai, the western Tarai and the Kathmandu Valley were -1.56, -0.38 and -0.79, respectively. Prices could fluctuate along with fluctuations in output.

Among other programmes, buffer stock is an important measure in maintaining a steady flow of rice in order to stabilize its annual prices. However, this programme is quite expensive for Nepal. It can also be ineffective if India experiences high instability of prices of rice. The instability of cereal grain prices and quantity available for domestic use were not particularly high in Nepal. Price stabilization programmes should receive low priority in the list of major agricultural policy priorities in the country.

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I would like to take this opportunity to express my deep gratitude to my late parents, Nirakar and Krishna Mathema, who had inspired me to study economics and had encouraged me to work in the field of food grain prices.

This work would not have been possible without assistance from the Ministry of Food and Agriculture, His Majesty's Government/ Nepal, and the Food and Agriculture Organization of the United Nations which arranged and provided a fellowship. This study could not have been completed without the financial assistance of the Department of Agricultural Economics and Rural Sociology, University of Alberta, after the termination of my F.A.O. fellowship in June, 1973. I express appreciation to these organizations for their kind assistance.

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CHAPTER 1

INTRODUCTION

In the 1960's, a substantial increase in the general price level was an important concern to the government of Nepal. One of the important objectives of the Five Year Economic Plans was to achieve economic stability through the reduction of the fluctuation of prices and foreign exchange rates.[1] The percentage increases of cereal grain prices were higher than the prices of other farm products and the prices of other daily necessities such as cotton textiles, sugar and kerosine oil.

Cereal grains (rice, maize, wheat and millet) account for the largest portion of the national income in Nepal. These grains are the main staple food and the major source of foreign exchange in Nepal. As cereal grains are the major source of income for the producers, the substantial increase of their prices may be an incentive to the producers to grow more grains. On the other hand, the rise in cereal prices may exert undue pressure on the living standard of the consumers, and the demand for grains may decline.

Besides the rising level of prices, price fluctuation is another major area of concern to the public. Instability of price creates uncertainty which causes distortion thus limiting specialization in the crops which yield the highest average return. The effect of price

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[1] HMG/Nepal, National Planning Council, The Second Plan (Nepal: National Planning Council, 1962).

uncertainty is the increase in the risk of trying new farm technologies such as use of new improved seeds and chemical fertilizers.[1]

Since the initiation of the planned process of economic development, the government of Nepal has made some efforts to maintain the level of grain prices and to reduce the fluctuation of its prices. Major emphasis is given to the increase in grain production. To reduce the fluctuation of prices, the operation of buffer stock was given importance in the economic plans. However, except for the procurement and sale of limited amounts of grains in certain areas of the Kathmandu Valley and the Hills, the buffer stock programme was not implemented to reduce the national and regional price fluctuations.

The study of the behaviour of grain prices and their relationship and the factors affecting them may help to examine the responsiveness of prices to the changes in factors such as the price movement in India, the changes in income, and the production of grains in Nepal. If the prices of grains respond to the changes in the level of production, the regulation of supply of grain may help to reduce the fluctuation of prices. In the following sections of this chapter, the location, physical features, population distributions, food grains production, and the export of grains from Nepal are described.

Location and Physical Features

Nepal, the birth place of Lord Buddha and the country of Mount Everest, is surrounded by the Tibetan region of China on the

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[1] F.A.O., The State of Food and Agriculture, 1967 (Rome: F.A.O., 1967), p. 77.

north, India on the west and the south, and a part of Sikkim and India on the east. It is a narrow landlocked country, approximately rectangular in shape, with an area of 140,792 square kilometers. It stretches along the southern slopes of the Himalayas for 800 kilometers east to west. Its breadth is between 128 and 192 kilometers, south to north. Nepal lies between 80.15 and 88.15 degrees east longitude and 26.20 and 30.10 degrees north latitude.[1] As King Prithive Narayan Saha (the father of modern Nepal) observed, geo-politically, Nepal "is a sapling between two rocks. Her survival, apart from the determination of the Nepalese people, largely depends on her skill and ability to maintain cordial relations with her two giant neighbours."[2]

The country can be divided into three major geographic regions: (a) the Tarai, (b) the Hills, and (c) the Himalaya regions. Entering Nepal via Northern India, one crosses the plain area of the Tarai region from east to west. The minimum altitude of this area is sixty-one metres above sea level. This region is the granary of the Kingdom and is also endowed with rich forest and wildlife resources (tiger, elephant, rhino).

The Tarai region is separated by different basins of several great rivers (including the Gandaki, the Kosi and the Karnali) which originate in the Himalayas. The region is made fertile by alluvia and sands brought by the numerous rivers. The Tarai has a subtropical climate with a maximum temperature of 40.6 degrees centigrade and

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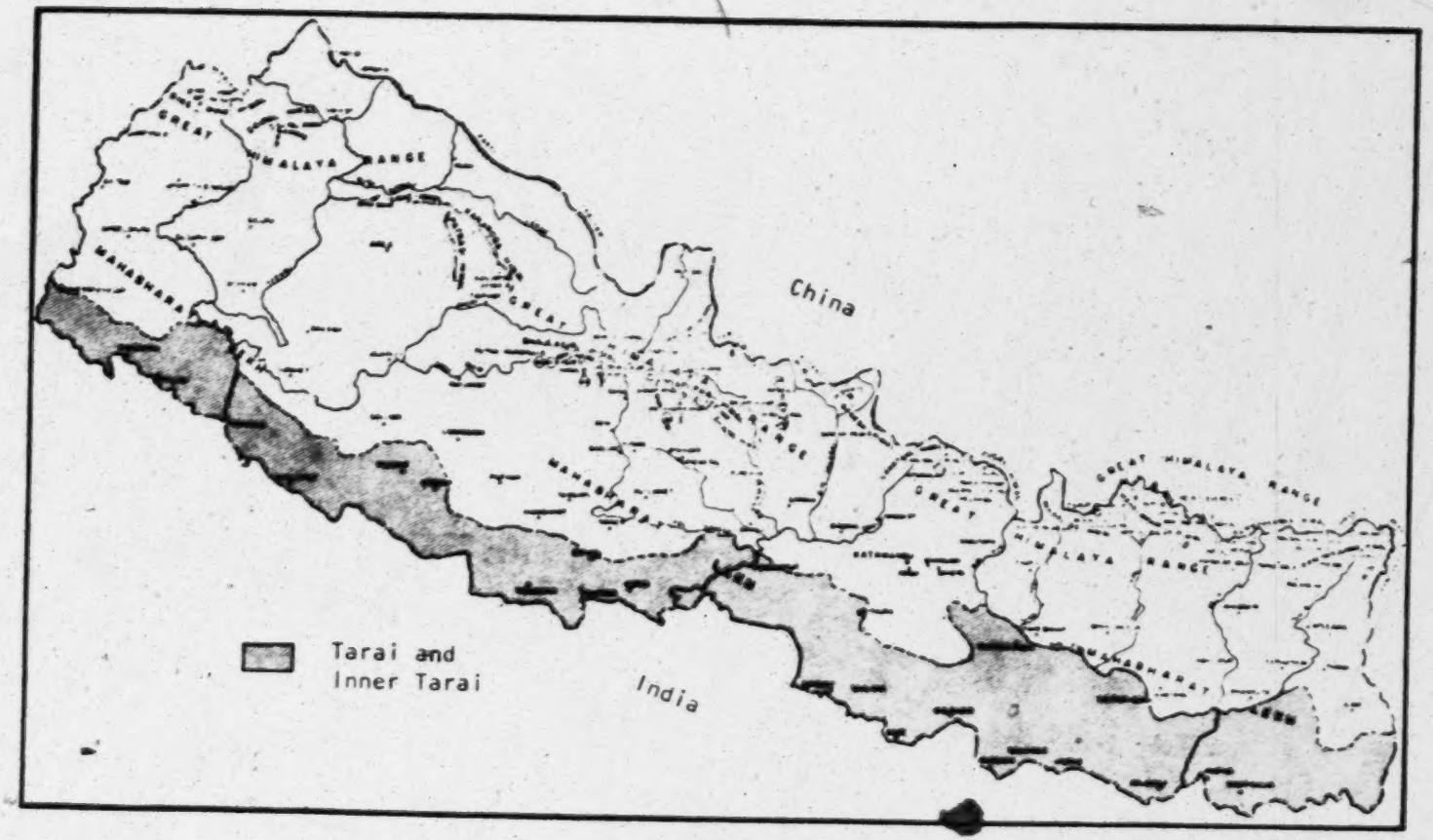
[1] U. M. Malla, "Land and the People," Nepal, Monograph on Nepalese Culture (Kathmandu: Ministry of Information and Broadcasting, 1970), p. 1.

[2] P. B. Khatri, Nepal: Towards Prosperity (Kathmandu: Dept. of Information, 1969), p. 2.

FIGURE 1.1

GENERAL MAP OF NEPAL



minimum temperature of 4 degrees centigrade. The western part of the Tarai has higher temperatures but a lower average rainfall than the eastern Tarai. The monsoon starts during early June in the east and during late July in the west. The annual average rainfall is 1,524 millimeters.

Twenty-five to sixty-four kilometers distance to the north of the Indian border, the Churia Hills begin. The Churia Hills have altitudes ranging from 610 meters to about 1,220 meters. On the northern side of these hills, there exists broad and spindle-shaped valleys including Rapti, Dang, etc. This part of the Hills has a rugged landscape in contrast to the more or less level surface of the Valleys.[1]

Further north, the extremely rugged mountainous part of the Hills region begins in the Mahabharat Range and stretches from east to west reaching altitudes of up to 3,049 meters. This area is populated with more than 50 percent of the total national population. There are abundant quartzite slates, phyllites, schists and marbles. The steeply sloped mountains are also habited and cultivated. Terraced rice farming is one of the important features of the region.

The Mahabharat Lekh area has a temperate climate rarely exceeding 27 degrees centigrade except in some valleys including the Kathmandu Valley where the maximum recorded temperature reached is 37 degrees centigrade. The rainfall in some areas commonly exceeds 2,540 millimeters, with 3,429 millimeters recorded in the Pokhara Valley.

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[1] U. M. Malla, "Land and the People," Nepal, Monograph on Nepalese Culture (Kathmandu: Ministry of Information and Broadcasting, 1970), p. 2.

Kaski district in the western Hills region. The far western hilly region, which covers one-third of the total Hills, has the lowest rainfall, but has more population with a deficit food grains production.

The third region, the Himalaya region, extends to the northern border of the country. The continuity of the great Himalaya region is broken by a number of transverse valleys such as the Karnali, Gandaki and Kosi. Mount Everest, the highest peak in the world, is located in this region. Some of the other highest peaks in the world are located on the northern border of Nepal. As the northern region contains numerous peaks, transportation is one of the main problems. A lack of efficient transportation system in the north is an important bottleneck in expanding trade with Tibet, and it is very costly to transport goods from this region to the Tarai markets.

From this thinly populated Himalaya region come the Sherpas, the skillful mountaineers. This region is rich in flora and fauna, including khair, fir, rhododendron, and juniper. The Himalaya region is also rich in wildlife, such as bear, ghoral, and ibex, and domesticated animals, such as sheep and yak. There is less rainfall than in the other two regions. The temperature does not go above 13 degrees centigrade and snowfall is a regular feature in virtually all of the region and particularly in areas exceeding 1,829 meters in elevation.

The soils are coarse in texture and vary from sandy loam to loamy sand in the Himalaya region. In the Hills, soils are mostly of clay loam, sandy clay loam and loam. The Tarai has alluvial soils. In

contrast to the generally acidic soil reaction in the Hills, the reaction of the Tarai soils varies from strongly acidic to nearly neutral.[1]

Thirteen percent of the total area of the country is agricultural land of which more than 66 percent is in the Tarai with the remainder being in the Hills and the Himalaya regions. The land under forest and permanent snow is 32 and 15 percent, respectively, and 19 percent of the land is unreclaimable. Eleven percent of the land area is below 305 meters elevation, whereas 50 percent of the land is over 1,524 meters above sea level (Appendices I and II).[2] The topography is heterogeneously rugged.

Nepal possesses various types of climate. Each region has some comparative advantages over other regions because of the variation of climate: the Himalaya range has the climate advantage for growing dry fruits, the Hills are climatically in a favourable condition for growing temperate fruits, and the Tarai grows bananas, papayas and mangoes. However, the rugged topography is a major factor responsible for the higher cost of transportation which limits the interregional flow of goods. This makes markets limited for regional products.

The price of rice transported from the Tarai to the Hills could be substantially higher in the latter region than in the former region. At present, the only truckable roads linking the Tarai and the Hills are the Raxaul-Kathmandu highway (Tribhuwan Rajpath) and the

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[1] Ministry of Food and Agriculture, Farm Management Study in the Selected Regions of Nepal, 1968/69 (Kathmandu: Ministry of Food and Agriculture, 1971), p. 3.

[2] K. B. Rajbhandari, Natural Environment and Crop Distribution in Nepal (Kathmandu: Ratna Pustak Bhandar, 1968).

Sonauli-Pokhara highway. After the completion of the Sonauli-Pokhara highway in 1968, the differences of prices of various farm products between Pokhara and Bhairahawa markets became small.[1] In other areas of the country, the interregional transportation of goods is very costly particularly during the monsoon season. It becomes difficult to solve occasional problems, such as severe shortages of grains and their higher prices in the Hills, through the transportation of grains from the Tarai to the Hills in a short period of time.

The topography on the northern part of the country creates difficulties in the promotion of trade between Nepal and China. This is one of the reasons for the heavy reliance upon the Indian markets for Nepal's surplus products such as grains.

The Population and Its Distribution

Nepal can roughly be divided according to the origin of her people. Most of the people of the Tarai, the Hills and the Himalaya regions are of Aryan stock, a mixture of Aryan and Mongolid stock, and of pure Mongoloid stock, respectively. Religious backgrounds parallel racial lines. The Tarai people follow Hinduism while the Hills people follow Buddhism or Hinduism, both having a high religious tolerance for each other. The people living in the Himalaya region are mostly Buddhists.

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[1] For detailed discussion of the impact of the Sonauli-Pokhara highway on the regional income and production see: Mark C. W. Shroeder, "The Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal" (Unpublished Ph.D. dissertation, Cornell University, 1971).

Nepali, the national language, is spoken by more than 60 percent of the people. Still, the country retains nine languages and numerous dialects. There are diverse ethnic groups with different characteristics, customs, and cultures. But unity in diversity is a characteristic of the Nepalese people.

Nepal had 11,289,000 people and a population density of 80 persons per square kilometer in 1971. Between 1961 and 1971, there was a 20 percent increase in population. The percentage distribution of the population increased in the Tarai and declined in the Hills. However, a higher percentage of the population in the country is still concentrated in the Hills and the Himalayan regions. The major cause of the rise in population in the Tarai is migration from the Hills. This migration is primarily from the western Hills--the highly populated, poverty stricken, food deficient region which has the worst transportation network in Nepal.

The low rate of population growth in the Hills might have eased the pressure of the additional quantity of cereal grains demanded. On the other hand, the rate of increase of the additional quantity of grains demanded must have been very high in western Tarai because of the higher rate of growth of population in the 1960's. This could have effects on the level of prices of grains.

Food Grains Production and Their Regional Distribution

During the First Plan (1956/57 - 1960/61), food grains production remained constant. The average annual increase was only 1.26 percent during the Second Plan (1962/63 - 1964/65). The real push in

food grains production has started since the beginning of the Third Plan (1965/66 - 1969/70). Excluding millet and other inferior grains production, the annual average rate of increase of cereal grains was 2.4 percent, slightly higher than the rate of increase of population. During the Third Plan, the rate of increase of grains production was promising, particularly in 1968/69 and 1969/70, when the annual increases were 4.94 and 3.56 percent, respectively (Appendix III).

Nepal had an estimated cereal grain surplus of 294,000 metric tons in 1970/71. The hilly region (including the Himalaya region) had a deficit of more than 250,000 metric tons of grains. On the other hand, the Tarai region had a surplus amounting to 544,000 metric tons of cereal grains.[1] Two-thirds of the total grains production was in the Tarai in 1969/70, but it had only 40 percent of the total population in 1971. Hence, there was a great disparity in the distribution of population and grains production between the Tarai and the Hills.

The eastern Tarai, with 25.7 percent of the population, had 40.46 percent of total grains and 54.52 percent of rice production in the country.[2] The western Hills, with 35.7 percent of the population, had 18.48 percent of the total grains and only 8.58 percent of rice production. During the Third Plan, the rate of increase of production was higher in the Tarai. Grain production, particularly in the eastern Hills, had decreased in 1969/70 compared to the level of production in 1965/66. If the migration from the Hills to the Tarai

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[1] T. Sakiyama, Evaluation of Third Plan Agricultural Performance (1965/66 to 1969/70) (Nepal: Ministry of Food and Agriculture, 1972), p. 92.

[2] Ministry of Food and Agriculture, Annual Report (1969/70) (Kathmandu: Ministry of Food and Agriculture, 1970).

had not increased in the 1960's, the population would have exerted mounting pressure on the food situation and caused a higher rate of increase of food grains prices in the Hills.

The per capita production of grains, particularly rice, is substantially lower in the Hills than the per capita availability of grains in the Tarai. The lowest per capita production of grains is in the western Hills. This regional disparity in grain production may cause substantial differences in regional prices. The levels of prices of grains might be higher in the Hills, particularly of rice in the western Hills, than in the Tarai.

Cereal Grains Export

Agricultural export constitutes 60 percent of the total value of national export. The share of rice in the total agricultural export is about 60 percent, followed by jute, ghee (clarified butter), and oilseeds. The export of maize and wheat is not significant (Appendix IV). Rice is the major export item contributing 40 percent of the total value of export.

During the 1960's, the volume of export of cereal grains declined slightly, particularly in the latter part of the decade. The average annual recorded export of rice was 93,394 metric tons during the First Plan period. It decreased to 91,315 metric tons during the Third Plan. The recorded export is only 25 percent of exportable surplus.[1] Because of the 800 kilometers of open border, the outflow of grains to India through unofficial trade points is not uncommon.

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[1] Ministry of Food and Agriculture, Annual Report (1969/70) (Kathmandu: Ministry of Food and Agriculture, 1970), Appendix I.

Of the total rice export to India, 75 percent comes from the eastern Tarai and the rest comes from the western Tarai. Paddy export is higher from the western Tarai. Though the estimated surplus of grains was about 190,000 metric tons in the western Tarai, the export through this region was about 50,000 metric tons (Appendix V). As the grain markets, particularly for rice, of the Tarai are also tied up with the grain markets of India, movements of prices of grains in India may affect the prices of grains in the Tarai region of Nepal.

Agriculture in the National Economy

Eighty-seven percent of the Nepalese population depends on the agricultural sector. Ninety percent of the labour force is engaged in agriculture. The agricultural sector's share in the gross domestic product was 65 percent in 1968-69. Rice is the main staple food and its farming occupies 62 percent of the agricultural land. Thus, the Nepalese economy is essentially an agricultural economy, with rice predominating as a crop.[1]

The agricultural sector received 32.2 percent of the total planned outlay in the First Plan, which started in 1956. This amount was second to the transportation and communication sector which had 33.8 percent. In the Second Plan, priority was shifted to industry and power which received the highest percentage of 32.2 percent. The allocation for agriculture and village development was only 19.5 percent. In the Third Plan, the agricultural sector received only 21.6 percent of

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[1] Pushpa R. Mathema, Agricultural Development in Nepal (Ombhal, Kathmandu: Shanti Printing Press, 1969).

the public sector outlay. Industry and power still received 24.2 percent (Appendix VI). In the present Fourth Plan, the agricultural sector has received the public sector's financial allocation of Rs. 703.9 million. Thus, the government's emphasis is both on agricultural and industrial development in the country. The major industries of Nepal are rice processing, and sugar, cigarette, and jute production. Rice and jute are major export products. Textile, leather, and steel products are manufactured, but the country is not self-sufficient. Nepal mainly has agro-based industries.

As stated earlier, cereal grains are important traditional crops which contribute the largest proportion to the national income. A year of cereal crop failure is liable to drastically lower the existing low level of national income. As grains are the important staple food, the decline in quantity supplied may substantially increase the level of its prices due to the inelasticity of its demand and supply. If the rate of increase of quantity demanded is greater than the rate of increase in the availability of cereal grains, the prices go up.

Price has an important role to play in the economic system. The conventional role is to improve resource allocation efficiency. It has an important role as a coordinator of economic activities unless there is intervention of government in the market. The foundation of such an argument occurs in the theoretical work of the 1930's, notably in the work of Edward Chamberlin and Joan Robinson.[1]

---

[1] Edward Chamberlin, The Theory of Monopolistic Competition (Cambridge: Harvard University Press, 1932); and Joan Robinson, Economics of Imperfect Competition (London: Macmillan and Co. Ltd., 1934).

An important role of price is inducing economic change. In the agricultural sector, commercial farmers may respond to a rise in prices of cereal grains by increasing production.[1] They may receive benefits from the increase in price. On the other hand, consumers, who are already spending the highest percentage of their income, may suffer if the rate of increase of income is lower than the rate of increase in prices.

The higher price level may restrict the export of grains to Nepal's traditional export markets in India unless prices are substantially higher in these markets than in Nepal. Besides, it becomes difficult to achieve the diversification of Nepalese rice export markets if the price of rice remains higher than the international price level.

At the regional level in Nepal, regional prices may vary due to the regional variation of the volume of cereal grains available in relation to the quantity demanded. The changes in factors, such as income, population, and prices of substitutes and complementarities, affecting demand for various grains may be responsible for changes in their prices. The increase in quantity demanded may induce price to rise, and the increase in quantity supplied may lead price to decline.

Measures such as regulation of volume of supply of cereal grains is important to maintain and stabilize their prices. An important factor governing quantity supplied is the volume of production.

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[1] For farm supply response to price in the Indian subcontinent, see: W. P. Falcon, "Farmer Response to Price in a Subsistence Economy: The Case of West Pakistan," American Economic Review, Vol. 54, Proceedings (May, 1964), pp. 580-591; and R. Krishna, "Farm Supply Response in India-Pakistan: A Case Study of the Punjab Region," Economic Journal, Vol. 73 (Sept., 1963), pp. 477-487.

Because of the heavy reliance of crop farming on natural forces such as rainfall, pest damage, and disease, grain production has more fluctuating tendency than the variation in industrial output. During the period 1961 to 1971, Nepal experienced drought in the years 1963, 1967, and 1971. Crop production was lower in these drought-stricken years. Fluctuations in output might be the important factor responsible for instability in annual price levels.

The fluctuations in quantity available for domestic use can be stabilized through the regulation of volume of export, and manipulation of stock of grains as well. The operation of buffer stock may help reduce the fluctuation of annual prices. An important factor in the successful operation of a buffer stock programme is the size of stock that is to be procured and disposed of according to the fluctuations in production. The study of behaviour of cereal grain prices and the analysis of the potential sizes of stock of grains may be helpful in forging some appropriate measures to maintain and stabilize the level of cereal grain prices in Nepal. The problem identification and the objectives of this study are dealt with in detail in the next chapter.

CHAPTER II

PROBLEMS OF PRICE BEHAVIOUR AND OBJECTIVES OF THE STUDY

Two years before the outbreak of the Second World War, the Nepalese living in the capital city of Kathmandu could purchase approximately four kilograms of Touli rice with one rupee.[1] Thirty-two years later, in the second quarter of 1970, the price of rice reached a level which was 7.5 times higher than the price in June of 1937. The price of wheat flour had increased more than ten times.

Price data have been available for the major market centres of the country only since 1961/62. In the 1960's, the weighted food grain price and the all-commodities price indices in Nepal had increased at an annual average rate of 8.8 percent and 7.6 percent, respectively.

The phenomenal price rise and its instability were some important problems.[2] The rise in prices of cereal grain is an important area in which considerable attention and policy measures are essential. As the expenditure on cereal grains constitutes the major proportion of the total consumer budget, the impact of the rise in prices of grains on the general consumer price level could be high. The conventional arguments against the rise in the general price level in Nepal are that it brings undue stress to the consumers' budget, particularly that of

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[1] Touli rice is a medium grade rice, and is popular among consumers in Kathmandu. The foreign exchange rate since March, 1973 is $1 U.S. equivalent to Rs 10.56. For prices of other grains in June, 1937, see: Gorakha Patra: A Weekly Newspaper (Kathmandu), June 15, 1937. The Nepali date is 30 Jestha, 1993 Bikram Sambat.

[2] Nepal Rastra Bank, Report of the Board of Directors to His Majesty's Government for the Fiscal Years 1961-1965 (Kathmandu: Nepal Rastra Bank, April, 1966), p. 8.

rentier, pensioner, civil servant and other fixed income groups, and it also raises prices of development materials and other factor costs which could slow down the pace of the achievement of the development programmes.[1]

It was also stated in the Second Plan of Nepal that severe inflation might be responsible for lack of progress.[2] Empirical evidences show different cases for different countries. The hypothesis that high rates of inflation slow down the rate of growth is inconclusive.[3]

Problems of Price Behaviour and Cereal Grain Development Programmes

One of the major obstacles in the formulation and implementation of appropriate price measures for the different regions of Nepal is the lack of studies on the behaviour of overall consumer price, particularly the prices of cereal grains, their relationships and the factors affecting them in different regions. Very limited information and data are collected and published.

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[1] HMG/Nepal, National Planning Council, Third Plan, 1965/66 to 1969/70 (Kathmandu: National Planning Council, August, 1965), p. 31.

[2] HMG/Nepal, National Planning Council, The Second Plan, 1962/63 to 1964/65 (Kathmandu: National Planning Council, 1962), p. 14.

[3] Lawrence R. Klein and Ronald G. Bodkin, et al., "Empirical Aspects of Trade-Offs Among Three Goals--High Level Employment Price Stability, and Economic Growth," Inflation, Growth and Employment in the Commission of Money and Credit (New York: Prentice-Hall, 1964), p. 403; Benjamin H. Higgins, "Financing Accelerated Growth," Government Finance and Economic Development (Paris: OECD, 1965), p. 21; and U. Tun Wai, "A Relation Between Inflation and Economic Development: A Statistical Inductive Study," International Monetary Fund Staff Papers, Vol. VII (1959/60), p. 302.

There is no publication with comprehensive coverage of the prices of various grains in the different regions of the country for the period 1961/62 to 1971/72. The statistical data and information about development programmes associated with prices are limited and scattered. Nepal Rastra Bank publishes price indices of a few consumer goods for three major geographic regions, namely the Tarai, the Hills and Kathmandu. Absolute price data are not published by the Bank. For instance, information on the level of price differences between the regions may be more important than the index of price movement for the interregional movement of grains.

It may not necessarily be true that the behaviour of cereal grain prices in eastern Tarai and western Tarai, and/or eastern Hills and western Hills are similar, and that the degree of response of the prices of various grains to the changes in the factors affecting them are of similar magnitude. If there are any differences, they may have important implications on the nature and type of regional programmes, and on the degree of emphasis on programmes in different regions to lower the rate of increase of the prices of grains. Therefore the degree of responsiveness of prices of grains in the different regions to the changes in factors affecting prices must be found.

An important factor associated with prices of grains is the volume of production. In the past, economic plans (First to Third Plans), priority was given to the cereal crop production sector. The cereal production target during the Third Plan was as follows:

TABLE 2.1

CEREAL PRODUCTION TARGETS IN THE THIRD PLAN, NEPAL

Grains	Estimated Production in 1964/65	Production Target, 1969/70	Percentage Increase Targeted During the Plan
		('000 Metric Tons)	
Paddy	2,201	2,368	7.5
Wheat	152	425	179.5
Maize	855	918	7.5

SOURCE: HMG/Nepal, National Planning Council, The Third Plan 1965/66 to 1969/70 (Kathmandu: National Planning Council, 1966), p. 58.

Among the various cereal crops, greater emphasis was given to wheat. The targeted total percentage increases of rice and maize production during the Plan were lower than the expected increase of population. The agricultural programmes were categorized as intensive and nonintensive development programmes.

The intensive programmes were concentrated in a few selected districts. The districts covered by the intensive agricultural development programmes (IADD) have greater potential for development in terms of soil condition, irrigation facility, transportation improvement and marketing services. The districts with resettlement programmes (DRP) also received a significant priority. Almost all Tarai districts, three districts of the Kathmandu Valley and a few districts in the Hills, such as Kaski and Doti, were under the above two groups. Except for the Kathmandu Valley, the Hill regions were low priority areas for the development of cereal crops (i.e., nonintensive agricultural development districts, NIADD).

Productivity of land increased substantially in DRP and IADD districts. Also, they had a greater potential for bringing new land under cultivation. But the land productivity increase in nonintensive districts, where potential for land reclamation was virtually non-existent, was very low during the 1960's. The annual average rates of increase in paddy land productivity in IADD, DRP, and NIADD were 2.7, 4.0 and 1.6, respectively, during the period 1961/62 to 1968/69 (see Table 2.2).

TABLE 2.2

PRODUCTIVITY OF LAND BY POLICY PRIORITY GROUPS

Policy Priority Groups	Paddy			Maize			Wheat		
	1961/62 (M/H)*	1968/69 (M/H)	Annual Rate of Increase (%)	1961/62 (M/H)	1968/69 (M/H)	Annual Rate of Increase (%)	1961/62 (M/H)	1968/69 (M/H)	Annual Rate of Increase (%)
DRP	1.48	1.89	4.0	1.13	1.67	6.8	0.67	1.32	13.8
IADD	1.92	2.28	2.7	1.84	2.09	1.9	0.83	1.40	6.9
NIADD	1.84	2.05	1.6	1.87	2.07	1.5	0.67	1.20	4.6

* Metric tons per hectare.

SOURCE: T. Sakiyama, Evaluation of Third Plan Agricultural Performance (Nepal: Ministry of Food and Agriculture, 1972), p. 17.

During the Third Plan, wheat production increased by 80 percent, and rice and maize increased only by 9 and 8 percent, respectively. As agricultural development programmes were concentrated in the eastern Tarai, western Tarai and the Kathmandu Valley, almost all the increase

in cereal production was recorded in these regions. Cereal production in the eastern and western Hills was even slightly lower in the final year, 1969/70, of the Third Plan than in 1964/65 (see Table 4.5).

Besides the problem area of finding the degree of responsiveness of grain prices to changes in factors affecting them in the different regions of Nepal, some other important problematic areas are as follows.

Is wheat production an important variable affecting the price of wheat flour as well as the price of rice and maize at the national and regional levels?

Is there any significant association between movements of prices of grains in India and Nepal, and the Tarai and the Hills?

If rice production is an important variable affecting price of rice, and if the price of rice rather than the price of wheat flour is a significant variable affecting prices of various cereals, the policy implications can be quite different. The emphasis might have to be shifted from the greater production of wheat to the increased rice production in order to maintain and stabilize price of cereal grains. If the price of rice is significantly associated with the volume of rice output, it reflects that the prices of rice may fluctuate with the fluctuations of the rice output.

In order to reduce the annual price fluctuations of cereal grains in general and the price of rice in particular, an important measure may be the regulation of the volume of supply of rice. The government of Nepal had a programme for procurement and sale of cereal grain. Before the establishment of the Agricultural Marketing and

Warehousing Corporation in 1971, the Department of Food (dissolved in 1968) and the Food Management Corporation were responsible for such activities. The grain sale activity of the Department of Food was concentrated outside the Kathmandu Valley, and the activities of the Corporation were concentrated in the Valley.[1]

Information on the volume of procurement and sale of grains by the above organizations are not available prior to 1965/66. For the first time in 1967/68, the Ministry of Food and Agriculture published the volume of cereal grains sold by the Corporation and the retail prices of the grains (Table 2.3).

TABLE 2.3

VOLUME OF RICE SOLD IN THE VALLEY BY THE CORPORATION

Fiscal Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
			(Metric Tons)		
1965/66	5,843	2,653	4,234	3,791	17,521
1966/67	2,762	1,607	1,544	1,252	7,165
1967/68	6,334	3,161	2,643	3,421	15,559
1968/69	3,851	1,423	1,122	2,054	8,423
1969/70	2,899	864	1,378	1,986	7,127

SOURCE: Ministry of Food and Agriculture, Annual Report for the Fiscal Year, 1969/70 (Kathmandu: Ministry of Food and Agriculture, 1970), p. 77.

[1] For objectives of the Food Management Corporation see: HMG/Nepal, Ministry of Land Reform, Food and Agriculture, Progress Report, 1967/68 (Kathmandu: Ministry of Agriculture, July, 1968), p. 71.

The Corporation had never procured grains in the Kathmandu Valley. Procurement of rice was done in the Tarai. The time and amount of procurement was not properly planned; it used to procure rice from the rice millers of the Tarai on a contractual basis.

The Corporation worked mainly to meet the supply need of the government organization, and to meet part of the deficit of grains in the Valley.[1] It had not functioned effectively in the stabilization of grain prices, nor in advising the government of the regulation of export of grains, nor in supply of grains to meet deficits in other parts of the country. The former Food Management Corporation had operated as a major procurement agency for the government rather than as a price stabilizing agency.

The size of procurement and sale of grains have an important role to play in the stabilization of prices.[2] A buffer stock programme

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[1] The report Cereal Grains Production, Consumption and Marketing Patterns, 1965 revealed that the Valley had a deficit of cereal grains amounting to 42,215 metric tons in 1965. The Ministry of Food and Agriculture estimated that the Valley had a surplus of grains in the amount of 3,000 metric tons in the fiscal year 1970/71. The estimation was based on the assumption that the per capita consumption was 160 kilograms. The estimated consumption of grains by the Valley dwellers may not be lower than in the Tarai because per capita income can be higher in the Valley than in the Tarai. If the consumption requirement per capita per year in the Valley was 190 kilograms, as in the Tarai, the Valley would have 14,600 metric tons of cereal grain deficit.

[2] The estimated relationship between the price of Touli rice and the volume of rice sold by the Corporation in the Kathmandu Valley was as follows:

$$Pt = 132.3003 - 0.0034Ma + 0.2253Pu - 0.0053Qu \qquad R^2 = 0.34$$

where:

Pt = Quarterly price of Touli rice, Rs per kilogram.
Pu = Quarterly price of rice, Rs per kilogram, sold by the Corporation.
Qu = Quarterly volume of rice sold by the Corporation in metric tons.
Ma = Quarterly market arrival of rice other than import and the sale by the Corporation, metric tons.

The estimated coefficients of Ma and Qu variables were significantly different from zero at the 95 percent level.

has been emphasised from the initiation of the First Plan to the present time. Recently, 50,000 metric tons of rice has been suggested as the size of Nepal's buffer stock. The size of stock is estimated on the basis of the guesstimate of the volume of marketable surplus of rice. The suggested size is 10 percent of the estimated marketable surplus.[1]

There were no estimations at the regional level. The behaviour of prices and the trend of production of grains may vary in different regions of Nepal. This may affect the proper size of buffer stocks for various regions. The operation of the buffer stock programme requires higher financial investment and adequate experience. Therefore the proper analysis of such a programme is very important and this has not been done in the past.

An important question is whether a buffer stock programme as a measure to stabilize domestic prices of grains around the trend is feasible or not in Nepal. Even if this programme is feasible there are many other indeterminate areas in the operation of buffer stock. Another major question to be examined in this study is whether the suggested size of 50,000 metric tons is adequate. If the size is adequate, how much are market prices allowed to fluctuate around the trend?

Does the western Tarai, though this region produces about 50 percent of the volume of cereal production in the eastern Tarai, need a greater size of stock of grain than the size of stock required for

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[1] C. Y. Lee, "Behaviour of Selected Food Grain Prices in Nepal," Ministry of Food and Agriculture, Nepal, 1971, p. 23. (Mimeographed.)

the eastern Tarai? The study of these problem areas and the behaviour of prices of grains will help in the formulation of a suitable cereal grain price policy and appropriate programmes to stabilize prices in Nepal.

Objectives of the Study

The following are the principal objectives of this study:

1. To describe movements of retail prices of cereal grain, rice, wheat flour and maize at the national and the regional level for areas such as eastern Tarai, western Tarai, eastern Hills, western Hills and the Kathmandu Valley.

2. To analyse factors affecting retail prices of cereal grain, rice, wheat flour and maize at the national and regional levels.

3. To make an analysis of the economics of buffer stock operation and to estimate potential sizes of buffer stocks for different regions of Nepal.

4. To make policy recommendations for the reduction of the fluctuations of cereal grain prices in Nepal.

The description of movements of the retail price of cereal grains provides information on the extent of regional price differences, variation in the rate of increase of prices of various grains, correlation of regional prices, the degree of price variations around the mean and the extent of instability of price around the trend. These are important in order to implement appropriate measures, and to put a proper degree of emphasis on the programmes for the maintenance and stabilization of prices in the different regions.

A statistical analysis of the factors affecting cereal grain price would assist in measuring the flexibility of prices and in determining the possible meagnitude of effects of various economic changes (such as change in the production of grain, change in the prices of substitutes in Nepal, movement of price of grains in India) on the prices of various grains in the different regions of Nepal. The results of such analysis are equally important for the regulation of demand and supply. For instance, the estimation of the relationship between the change in price and the level of production of rice could be useful in determining the volume of size of stock to be procured or disposed of in order to reduce the possibilities of price fluctuation caused by the annual variation in the level of domestic output.

The operation of buffer stock may be one of the effective measures for the regulation of the volume of domestic supply in order to achieve the stability of prices in the domestic markets if there is significant relationship between the variations in prices and the level of production of a commodity, and if price movements in Nepal are not significantly associated with movements of prices in India. The degree of fluctuations in production of grains may vary in the different regions, which may affect sizes of initial stocks to be required in the different regions. Hence, the estimation of the appropriate sizes of stock for the various regions of Nepal will help to examine whether the operation of a buffer stock programme can be economically feasible.

The analysis of price is carried out with the conventional economic tools of demand and supply. Demand and supply are different from consumption and production of a commodity. Supply of a commodity indicates a schedule of possible price-quantity combinations. A change

in supply involves shifting the entire supply curve, whereas production refers to the quantity produced at a specific point of the supply curve. Similarly, the quantity purchased refers to movements along a given demand curve.

Other things remaining the same, an equilibrium price is established at the point at which demand equals supply. The movements in price of a commodity such as cereal grain are caused by changes in demand and supply. The degree of change in price depends on the extent of variation in supply and demand as well as the elasticities of demand and supply.

The demand for agricultural products such as rice is inelastic because the commodity is a basic staple food and because there are only a few alternative uses for resources such as land and farm labour, and because the short-term adjustment is restricted due to the biological influence on farming. These demand and supply inelasticities cause the instability of price in the short run.

The elementary economic theory states that changes in demand are caused by growth in population, variation in income, change in the price of substitutes and complementarities. Supply depends upon the level of production, as well as the management of stock and the regulation of external trade.

The production of agricultural commodities such as rice, maize and wheat depends not only on man's efforts to change acreage and to improve the technology but upon the variation of weather, disease and pest damage. With the variation of the natural forces, supply of the commodities may shift from year to year. In the short period of a

decade the supply instability can be greater than the fluctuation in demand for grains. Because of the frequent occurrence of flood and drought in Nepal, the regulation of the volume of supply may be important in order to stabilize price. One of the important measures to reduce frequent wide fluctuations in supply of grain is the acquisition and disposal of its stock.

In Chapter III, movements of the national consumer price level and regional prices of cereal grains are described. The factors affecting prices of cereal grains in Nepal are discussed in detail in Chapter IV. The statistical analysis of factors governing prices of cereal grains in Nepal and her regions are carried out in Chapter V. The economics of operation of buffer stock are dealt with in Chapter VI.

CHAPTER III

CEREAL GRAIN PRICE MOVEMENTS

The prices studied are consumer prices and cover the period 1961/62 to 1970/71. Price data are mostly from the Rastra Bank of Nepal and its regular publications. To the end of 1970, the bank published the national and regional price indices of fifteen commodities. But since January, 1971, this has been reduced to price indices for thirteen commodities for the three regions only. All price indices are unweighted.

All the commodities except kerosine oil and cotton textiles are food items. No prices for fruits and vegetables, liquor and tobacco, fuel, power, light and lubricants, industrial raw materials and other manufactured foods and chemicals are published. Hence, all the unweighted commodity price indices for Nepal and regions do not fairly represent the general consumer price index.

Eight markets were covered for the national price index published by the Nepal Rastra Bank: four main market centres (Biratnagar, Birjung, Bhairwa and Nepaljung) out of the twenty-two main markets are from the Tarai; three main markets out of fifty markets are from the Hills, and one out of three markets is from the Kathmandu Valley. These representative market centre districts had only 15 percent of total population and 23 percent of rice production in 1970. Hence the average price of the eight market centres may not be a reliable representation of the national price of food grains. For instance, the

Bhojpur market price alone can hardly represent the price situation of the eastern Hills with its fourteen main markets.[1]

All-Nepal Unweighted Price Movements

The All-Nepal (National) unweighted price index for the period 1961/62 to 1970/71 indicates three distinct features of price movements (Table 3.1). The price indices of all commodities, food articles and food grains show a continuous high rate of increase up to 1965/66, a substantial decline in 1966/67, and the restoration of the 1965/66 price level by 1967/68. Also observed is the moderate rate of increase of prices with relatively moderate fluctuations.

In 1962/63, there was about a 6 percent rise in all-commodity prices mainly because of the substantial increase of prices for pulses, cuminseed, salt and milk by 12.25, 34.42, 14.70 and 24.77 percent, respectively. Although the aggregate cereal price dropped by 2 percent, the food grains price was increased due to an increase in the price of pulses. The all-commodity price index went up from 106.38 in 1962/63 to 116.40 in 1963/64 because the price of coarse rice increased from the index of 102.60 to 124.47 and the price of pulses rose from 112.25 to 131.96.

The year 1964/65 saw the highest percentage increase for all the products except cuminseed, salt and milk. The prices of all-commodities, food articles and food grains rose from 116.40, 119.03

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[1] For details on sources and nature of price data available in Nepal, see Appendix VII.

FIGURE 3.1

MARKET CENTRES COVERED FOR NEPAL RASTRA BANK'S NATIONAL PRICE INDEX

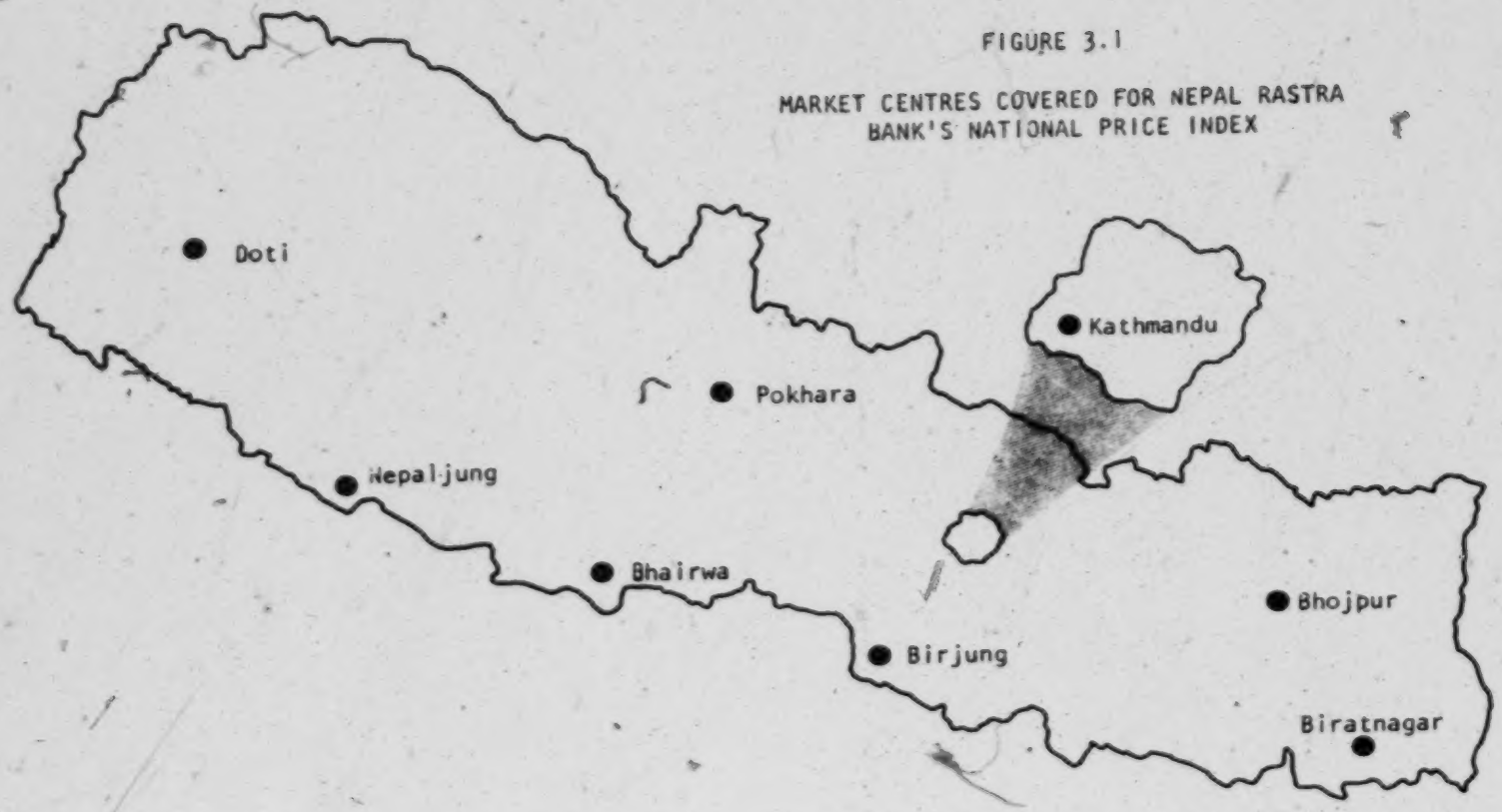

TABLE 3.1

ALL-NEPAL UNWEIGHTED PRICE INDEX FOR FISCAL YEARS 1961/62 TO 1970/71

Fiscal Years	All Commodities[a]	Food Articles[b]	Food Grains[c]
	(Base: 1961/62 = 100)		
1961-62	100.00	100.00	100.00
1962-63	106.38	106.65	105.29
1963-64	116.40	119.03	122.50
1964-65	132.74	158.93	168.83
1965-66	144.87	167.35	205.40
1966-67	118.45	142.17	170.81
1967-68	141.77	170.82	209.79
1968-69	147.02	160.12	181.81
1969-70	146.75	157.68	171.47
1970-71	161.19	164.25[d]	175.71

Note: Fiscal year is from Mid-July/Mid-August to Mid-June/Mid-July.

a All Commodities: food articles plus kerosine oil and cotton and textile (both imported).

b Food Articles: food grains plus potatoes, mustard oil, purified ghee, sugar (imported as well), pepper, cumin-seed (imported), milk, and salt (imported).

c Food Grains: Rice (coarse), wheat flour (imported from India), rahar and gram (imported as well), black gram.

d Pepper and cuminseed excluded.

SOURCE: Nepal Rastra Bank, Quarterly Economic Bulletins, Vol. V and VI (October, 1970 and 1971).

and 122.50 in 1963/64 to 132.74, 158.93 and 186.83 in 1964/65, respectively. The rise of average food grains prices was spectacular because of the increase of the price of wheat flour (Indian) from the level of 101.63 to 233.18, and the rise of prices of rice and pulses from 124.47 and 131.96 to 150.0 and 182.07. Among other food articles other than food grains, the high rise of potatoes, mustard oil, and purified ghee prices resulted in the increase of the food articles price index from 119.03 in 1963/64 to 158.93 in 1964/65.

The all-commodities prices index rose to 144.87 in 1965/66 mainly due to a rise in cereal and kerosine prices. The prices of pulses were stable but the prices of other food articles slightly declined. In 1966/67, the prices of the all-commodities, food articles, and food grains groups dropped from 144.87, 167.35 and 205.40 to 118.45, 142.17 and 170.81, respectively. The only commodity with a small rise in price was rice, which increased about 1.2 percent.

The price level in 1967/68 reached the level of 1965/66. The price of food items was slightly higher than the 1965/66 level. Price of rice, pulses, potatoes and sugar reached the highest level of all the years under study. The highest recorded price indices of the above commodities were 189.39, 214.41, 130.65 and 151.64 in 1967/68.

The prices of food grains declined for two years and increased further in 1970/71. However, the 1970/71 price level was substantially below the 1967/68 price level. The prices of food grains had a more annual fluctuating tendency than the prices of all-commodities and the food articles groups.

All-Nepal Weighted Consumer Price Movements

The calculated national weighted consumer price index had had an increasing trend up to 1965/66, which was similar to the situation shown by the unweighted price index (Table 3.2).[1] The index dropped in 1966/67; the magnitude of the drop of the weighted prices, particularly for the food grains group, as compared to the unweighted index was low. The differences were found since 1967/68. The all-commodity index rose from 149.48 in 1965/66 to 160.32 in 1967/68. But the unweighted index showed that the 1967/68 index was three points below the 1965/66 level. The weighted index dropped in 1968/69 and then continued to increase since 1969/70.

One of the important conclusions that can be stated comparing these two sets of price indices is that the unweighted price index overestimated the price movements of food grains, but underestimated the movements of the all-commodities price index. The differences between the weighted and unweighted price indices, particularly of food grains, were generally wide (Figure 3.2).

Price Movements of Cereal Grains

Cereal grains constitute the most important items of food in Nepal and are the major source of national income.[2] As already stated,

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[1] The total value of marketed products for 1964/65, the price data used to calculate the total value of the products, and the respective weights of those commodities included in the calculation of the weighted consumer price index are given in Appendix VIII.

[2] Cereal grains include rice, maize, wheat, millet and other inferior grains such as buckwheat. Food grains include cereal grains as well as pulses.

FIGURE 3.2

COMPARATIVE PICTURE OF UNWEIGHTED AND WEIGHTED PRICE MOVEMENTS, NEPAL

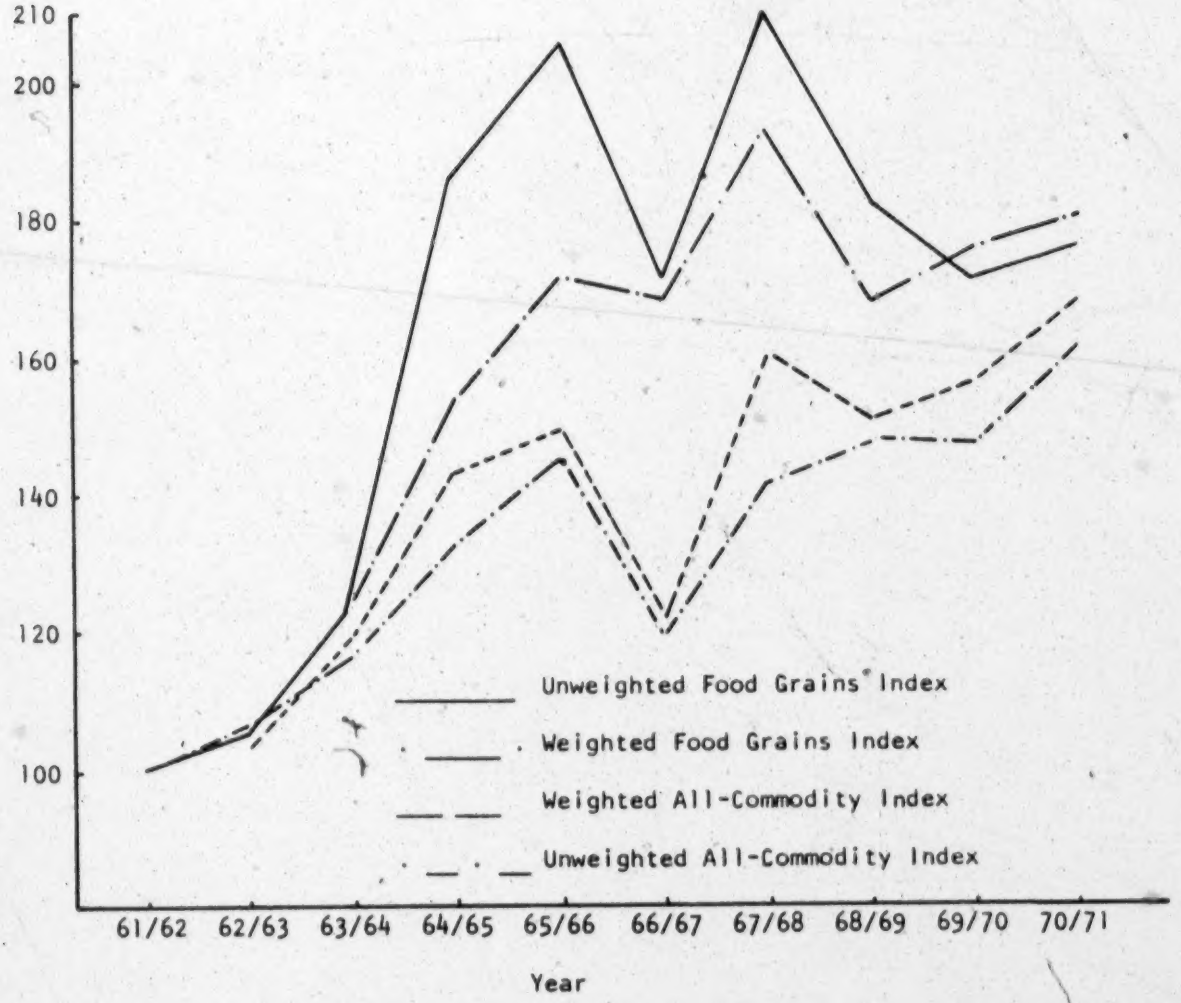


TABLE 3.2

ALL-NEPAL WEIGHTED CONSUMER PRICE INDEX

Fiscal Year	All-Commodities	Food Grains	Other Food Articles	Total Food Articles
Weight	100.00	51.77	23.95	75.72
		(Base Year: 1961/62 = 100)		
1961/62	100.00	100.00	100.00	100.00
1962/63	103.43	103.70	111.37	106.12
1963/64	118.74	125.25	124.17	124.90
1964/65	142.72	154.11	154.93	154.37
1965/66	149.48	171.22	148.44	164.01
1966/67	120.21	168.19	130.38	156.23
1967/68	160.32	192.46	145.40	177.58
1968/69	150.60	167.11	148.52	161.23
1969/70	156.33	175.94	153.10	168.72
1970/71	168.15	180.22	172.53	177.83

SOURCE: Nepal Rastra Bank, Quarterly Economic Bulletin, Vol. VII, No. 3 (Mid-April, 1973).

the Rastra Bank's publication on the price index of cereals includes only rice and imported wheat flour. However, the contribution of prices of wheat grown in the country and the prices of maize to aggregate cereal grain prices cannot be given lesser importance. The inclusion of maize and local wheat flour prices does help to represent a relatively more realistic picture of the movements of cereal grain prices.

The absolute monthly prices of rice, maize, wheat and wheat flour in fifteen main market centres of the country as provided by the Nepal Rastra Bank are used in the present analysis. The various local volume and weight measurement units used for quoting prices are presented along with conversion rates in Appendix IX. All prices reported in local measurements are converted into the metric system. The weighted cereal grains price index for each year is constructed on the basis of the percentage contribution of rice, maize and wheat flour to the total national production, excluding millet and other inferior grains.

Unweighted Prices of Cereal Grains

The unweighted cereal grain price increased at an annual average rate of more than 7 percent. The index of all cereals reached 170 in 1970/71 from the base period of 1961/62. Cereal grain prices increased rapidly during the period 1963-66, and since 1966/67, the prices had an annual fluctuating tendency (Table 3.3).

The movements of unweighted prices of rice, wheat flour and maize are positively correlated. The correlation coefficient of price between rice and wheat flour is .94, and the correlation coefficient between prices of rice and maize is .83. Thus the wheat flour price is

TABLE 3.3

UNWEIGHTED CEREAL GRAINS PRICE INDICES, NEPAL[a]

Year	Rice	Maize	Wheat Flour	Cereal Grain[b]
		(Base Year: 1961/62)		
1961/62	100.00	100.00	100.00	100.00
1962/63	95.37	106.45	84.21	92.63
1963/64	118.51	190.32	102.63	127.37
1964/65	136.11	183.87	157.01	154.74
1965/66	171.29	211.29	197.36	189.47
1966/67	166.66	180.64	155.26	164.21
1967/68	199.07	225.80	206.14	207.37
1968/69	175.92	209.67	189.47	188.42
1969/70	166.66	170.96	164.91	166.32
1970/71	175.92	177.28	163.16	170.53

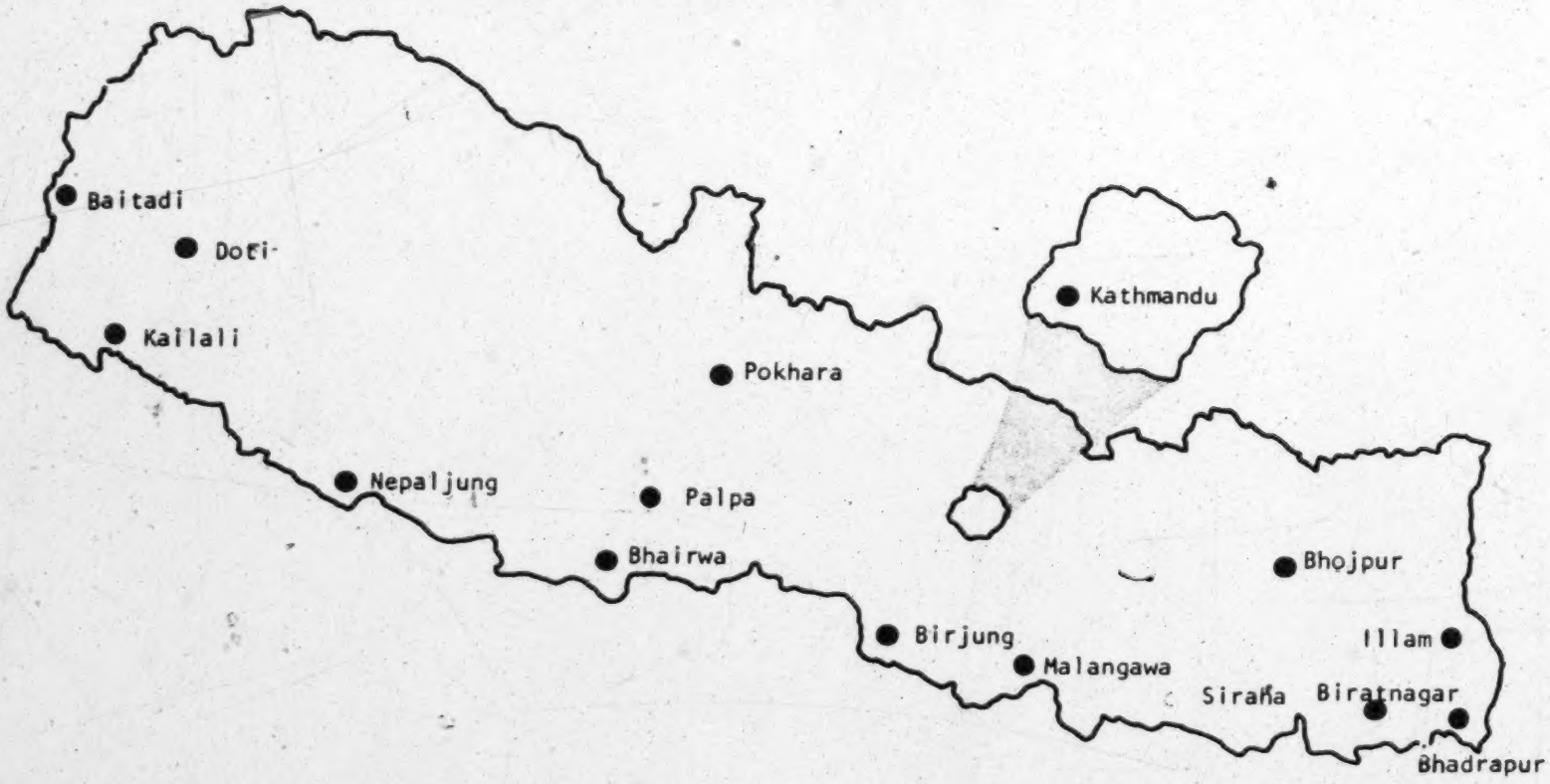
[a] Average prices of five regions--Kathmandu Valley, eastern Tarai, western Tarai, eastern Hills and western Hills. Eastern Tarai prices comprised of average prices of five market centres--Bhadrapur, Biratnagar, Siraha, Malangwa and Birjung; western Tarai price is the average of three markets--Bhairawa, Nepaljung and Kalali. Palpa, Pokahara, Doti and Baitadi market centres represent the western Hills, and the eastern Hills price is the average of two market centres, namely Illam and Dhankuta. Altogether, fifteen market centres are included in the national average whereas the Rastra Bank national average is of eight market centres.

[b] Index of cereal grain is calculated directly from average cereal grain price. Therefore, the average of price indices for rice, maize and wheat flour may not tally.

SOURCE: Information from Nepal Rastra Bank and U.S.AID/Nepal.

FIGURE 3.3

MARKET CENTRES COVERED FOR
PRICES IN THIS STUDY



more correlated with the price of rice than maize. The matrix of correlation between prices of various grains are as given below:

TABLE 3.4

CORRELATION BETWEEN PRICES OF VARIOUS GRAINS, NEPAL

	Rice	Wheat Flour	Maize	Paddy
Rice	1.000			
Wheat Flour	0.944	1.000		
Maize	0.829	0.839	1.000	
Paddy	0.976	0.936	0.836	1.000

Weighted Cereal Grain Prices

Aggregate cereal grain prices, if weighted according to percentage contribution to total cereal grain production of various grains each year, increased by more than 8 percent per annum. Compared to the unweighted price of rice, the weighted price was found to be higher in some years and lower in other years during the period 1961/62 to 1970/71 (Table 3.5).

In 1966/67, the weight of rice in the aggregate cereal grain production was decreased because of the substantial decline in its production, and a decline in its price was also recorded. The situation was reversed in the year 1970/71; the price as well as the weight of rice production had increased. When forces such as price and weight of a commodity move in the same direction, the degree of change of weighted price index becomes greater than the change indicated by the unweighted index.

The calculated weighted price of maize was always lower than the unweighted price. On the other hand, the weighted wheat flour price was greater than the unweighted one. The substantial difference between the weighted and unweighted price of flour occurred because of the substantial increase in the production of wheat.

TABLE 3.5

WEIGHTED CEREAL GRAIN PRICE INDICES, NEPAL

Year	Rice	Maize	Wheat Flour	Cereal Grain
		(Base Year: 1961/62)		
1961/62	100.00	100.00	100.00	100.00
1962/63	95.76	105.82	85.19	97.80
1963/64	118.65	189.92	104.11	136.26
1964/65	139.34	180.70	141.41	150.55
1964/66	173.73	205.82	205.14	184.62
1966/67	163.72	180.14	185.90	170.33
1967/68	197.13	218.56	269.16	208.79
1968/69	173.42	198.35	281.06	187.91
1969/70	164.67	159.76	252.86	170.33
1970/71	180.16	161.63	216.30	179.12

SOURCE: Information from Nepal Rastra Bank and U.S.AID/Nepal.

Rice Price Movements

The highest price of rice was recorded in the western Hills of Nepal, followed by the eastern Hills. The price level in Kathmandu was midway between the price levels in the Hills and the Tarai. Price in the western Tarai was the lowest of all regions in the country (Table 3.6). The Hills had an annual cereal grains deficit of about 250,000 metric tons, and a part of this deficit was met with the inflow of grains from the Tarai. Transport cost was very high, particularly in the western Hills. Therefore, the price level was higher in the Hills. As the cost of transportation was higher in the western Hills than in the eastern Hills, the price level of rice in the western Hills was generally higher than the prices in the eastern Hills. Price difference between the lowest and highest price regions, such as the Tarai and Hills, was around Rs. 0.60/kg.

One used to experience lower rice prices as one moved from the eastern part of the Tarai to the western Tarai. It was reversed in the Hills, from the eastern to the western Hills. Paddy produced in the eastern Tarai was marketed mostly in the rice consuming markets of West Bengal and Bihar, the bordering states of India, where rice was in short supply. Eastern Tarai rice used to receive a high price in Bengal and Bihar. But the western Tarai rice was exported to Uttar Pradesh where rice was not in demand as much as in Bengal. The prices of rice in Bengal were higher than in U.P.[1]

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[1] C. Y. Lee, "Behaviour of Selected Food Grains Prices in Nepal," Nepal, December, 1971, pp. 18-19. (Mimeographed.)

TABLE 3.6

CONSUMER PRICE OF RICE IN NEPAL BY REGIONS

Year	Nepal	Kathmandu	Tarai	Hills	East Tarai	West Tarai	East Hills	West Hills
				(Rs/kg.)				
1961/62	1.08	1.10	0.91	1.29	0.94	.86	0.98	1.45
1962/63	1.03	1.21	0.89	1.20	0.96	0.77	0.96	1.32
1963/64	1.28	1.34	1.11	1.51	1.18	0.98	1.36	1.59
1964/65	1.47	1.52	1.26	1.74	1.27	1.24	1.45	1.88
1965/66	1.85	1.56	1.70	2.09	1.73	1.65	1.74	2.27
1966/67	1.80	2.00	1.60	2.07	1.60	1.61	1.88	2.20
1967/68	2.15	1.83	2.00	2.44	2.02	1.96	2.07	2.58
1968/69	1.90	1.83	1.71	2.17	1.71	1.69	2.24	2.14
1969/70	1.80	1.91	1.70	1.91	1.69	1.72	1.83	1.94
1970/71	1.90	2.04	1.62	2.16	1.66	1.58	2.11	2.18

SOURCE: Information from Research Department, Nepal Rastra Bank, Kathmandu, Nepal.

The price difference between the Tarai regions was not as wide as was observed between the Hills regions. The range of price difference per kilogram of rice recorded for the Tarai regions was Rs 0.08 to Rs 0.20, and the range of prices between the eastern and western Hills was Rs 0.23 to Rs 0.53. On the other hand, the difference between the eastern Tarai and the Hills was not as large as generally observed between the western Tarai and the Hills. The relative scarcity of grains in the western Hills and the higher cost involved in transportation as compared to the eastern Hills accounted for the wide differences between the price of rice in the western Tarai and the western Hills. The distance between the southwestern and northwestern parts of Nepal is twice that of the distance between southeastern and northeastern Nepal. The average price difference between eastern Tarai and the Hills was about Rs 0.29 and between western Tarai and the Hills, around Rs 0.58.

Annual Price Movements

In Nepal during the period 1961/62 to 1970/71, Rs 2.15 retail price per kilogram of rice was the highest price recorded (in 1967/68), while the lowest price level was Rs 1.03 per kilogram (in 1962/63) (see Table 3.6). Price of rice increased at a rate of 17 percent up to 1965/66. In 1966/67, the price dropped 2.7 percent from the previous year. That year, paddy production was 9 percent below the level of 1965/66. But, instead of the expected increase in price, a drop in the price level was observed. In 1966/67, one of the important economic

changes was the revaluation of Nepalese currency vis-a-vis Indian currency.[1]

In 1967/68, the price was about 20 percent higher than the level of 1966/67. The level of paddy production was higher by 0.45 percent compared to the 1965/66 level. An important phenomenon in price movement that year was the increase of price during the post-harvest period. The important change that happened during this post-harvest period was the devaluation of Nepalese currency.[2] In 1968, neighbouring states such as Bihar, Uttar Predesh and West Bengal had a good harvest of cereals (see Appendix X). The continuous good harvest of paddy crops in 1968/69 and 1969/70 in Nepal, as well as in the neighbouring states, helped hold down the price level.

Regional Movements

The annual movement of price in the Kathmandu Valley was different from price movement in the Tarai and the Hills. Between 1961/62 to 1965/66 prices rose steadily. By 1965/66, the annual average increase of price of rice was 10 percent in the Valley, 15 percent in the Hills, and 20 percent in the Tarai. A steep rise in price in the Valley occurred in 1966/67 when the Tarai and the Hills experienced a substantial decline in price. A steep rise in price occurred in the Hills and Tarai in 1965/66, but the Valley observed only a moderate increase in price. The price in Kathmandu dropped by 10 percent in 1967/68. That year paddy production increased by about 5 percent. The then Food Management Corporation's sale of rice in the Kathmandu Valley was 15,559

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[1] On June 6, 1966, NC/IC exchange rate was changed from Rs160 to Rs 101.25 per Indian Rs 100.00 .

[2] N.C. was devalued by 24.78 percent on December 8, 1967.

metric tons in 1967/68, two times higher than the amount of distribution in 1966/67. On the other hand, distribution, particularly in the Hills, was negligible. In 1970/71, Kathmandu and the Hills experienced a high rise in price. The Hills had a bad crop. The Tarai also had a bad crop but a decline in price level was recorded.

In 1964/65, the index for the eastern Tarai was 135 and 114 for the western Tarai. In 1970/71, the price index for the western and the eastern Tarai reached 184 and 176, respectively. The tremendous rise in price in the western Tarai occurred since 1965/66. This region also experienced more price fluctuations than the eastern Tarai. On the other hand, the rise in the level of price was less in the western Hills except in the year 1967/68. By 1970/71, the index for the eastern Hills reached 215 but it was only 150 for the western Hills. On the whole, the western Tarai and the eastern Hills experienced higher rates of increase of prices and more annual fluctuations.

The relatively low rate of increase of price of rice in the western Hills may be the result of the low rate of increase in population (only 10 percent in a decade). Crop production had increased slightly. Outside the Kathmandu Valley, the western Hills region was the priority area for government food distribution. In terms of public investment, that region received the least priority, and last but not least, the high cost of transportation was eased since 1967/68 because of improvements in transportation facilities, particularly in the two representative markets of Palpa and Pokhara.

The eastern Hills have experienced low paddy production since 1965/66. The population increase was slightly higher in this region

than in the western Hills. No transportation improvement was experienced in the representative markets.

The Kathmandu Valley experienced the annual simple average rate of increase of price of rice of 17 percent during the period 1961/62 to 1966/67. During that period, rice production increased by about 4 percent per annum. Population, an important factor for increasing demand, had increased by 3 percent annually. The valley used to absorb more than 30 percent of the annual government expenditure.[1] In 1962/63, about 33 percent of the development expenditure was allocated to this region. The increase in the quantity of rice demanded might be the major factor responsible for the high rise in prices for the period 1961/62 to 1966/67.

The production of rice after 1966/67 increased at an annual average rate of 17 percent. This encouraging rate of growth might be the factor responsible for checking the rise in the level of price in Kathmandu. The index from 1967/68 to 1970/71 remained below the index of 1966/67.

Correlation of Regional Prices

The prices of rice in various regions of the country were positively correlated. The movement of prices between the eastern and western Tarai were highly correlated. The correlation of prices between the Hills and the Tarai were higher than the correlation between the two regions of the Hills. Although Kathmandu prices were less correlated to Tarai prices than were the eastern and western Hills prices, correlations were still very high (Table 3.7).

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[1] B. P. Shrestha, Monetary Policy in an Emerging Economy (Kathmandu: Ratna Pustak Bhandar, 1965).

TABLE 3.7

CORRELATION COEFFICIENT MATRIX OF PRICES OF RICE IN NEPAL AND REGIONS

	Nepal	Kathmandu	East Hills	West Hills	West Tarai	East Tarai
Nepal	1.000					
Kathmandu	0.880	1.000				
E. Hills	0.953	0.917	1.000			
W. Hills	0.972	0.800	0.887	1.000		
W. Tarai	0.988	0.867	0.925	0.951	1.000	
E. Tarai	0.991	0.841	0.924	0.959	0.988	1.000

Maize Price Movements

Annual Price Movements

During the period reviewed in this study, the highest price of maize was recorded in 1967/68 and the lowest price was in 1961/62 (Table 3.8). Up to 1965/66, maize prices had an increasing trend similar to that of rice. The price went down from Rs 1.31 per kilogram in 1965/66 to Rs 1.12 per kilogram in 1966/67 in spite of a 4 percent decline in maize production that year. The major factor leading to the decline of the maize price might be the decrease in the price of rice. Maize price is found to generally follow the rice price. The correlation coefficient between the prices of rice and maize is 0.829.

Maize production in 1967/68 was 6 percent higher than in 1966/67, and the price reached the record high level. The continuous decrease of prices of rice and the increasing production of maize

TABLE 3.8

CONSUMER PRICE OF MAIZE, NEPAL AND REGIONS

Year	Kathmandu	East Tarai	West Tarai	West Hills	East Hills	Nepal
			(Rs/kg)			
1961/62	0.62	n.a.	n.a.	n.a.	n.a.	0.62
1962/63	0.66	n.a.	n.a.	n.a.	n.a.	0.66
1963/64	0.77	1.39	n.a.	n.a.	n.a.	1.18
1964/65	1.00	0.98	1.10	1.50	0.93	1.14
1965/66	1.12	1.30	1.02	1.55	1.27	1.31
1966/67	1.27	1.13	0.90	1.32	1.18	1.12
1967/68	1.23	1.43	1.03	1.81	1.13	1.40
1968/69	1.12	1.30	1.42	1.32	1.14	1.30
1969/70	1.02	0.96	1.01	1.25	1.11	1.06
1970/71	1.10	1.18	0.81	1.21	1.06	1.10

SOURCES: Information from Research Dept., Nepal Rastra Bank, Kathmandu, Nepal; U.S.AID/Nepal, Kathmandu.

brought a decline in maize price in 1968/69 and 1969/70. Maize production dropped by 9.5 percent in 1970/71. That year the price of rice was increased.

Regional Price Variations

The highest price of maize was in the western Hills, which supports high correlation with the price of rice because the price of rice was the highest in that region. On the other hand, the lowest price of maize was not only recorded in the western Tarai, where the price of rice was generally lowest; its lowest price was also recorded in the eastern Hills for two years during the period 1964/65 to 1970/71.

Comparing maize price levels of the western Tarai and the Hills, it is generally found that the price in the western Hills was higher than in the western Tarai by Rs 0.40 to 0.50 per kilogram. This price difference was not wide enough to transport the western Tarai's surplus maize to all the districts of this region. Tarai maize usually moves into the Hills districts bordering the Tarai.

The price situation of maize between the eastern and the western Tarai was not similar to the rice price situation. It was observed that in some years the price was low in the east and in other years it was low in the west. However, the price difference between these regions was very low (that is, the range was Rs 0.50 to Rs 0.12 per kilogram) whenever the price was lower in the eastern Tarai. When the western Tarai had lower prices than the eastern Tarai, the range observed was Rs 0.23 to Rs 0.40 per kilogram, which was very high compared to the range of price differences for rice.

The interregional movements of maize from the western Tarai to the eastern Tarai can be increased to meet occasional shortages of maize in certain market centres such as Biratnagar. Transportation cost will be lower after the completion of the East-West Highway by 1975/76. At present, maize produced in Chitwan, the nearest important maize surplus district to the east, can be moved to the Biratnagar market because of a better transportation link. The Chitwan district is surrounded by deficit areas with high prices of maize so its movement is more towards the Kathmandu, Gorakha, Tanahu and Lamjung districts.

In the case of price difference between the eastern and the western Hills, the maize price was lower in the eastern Hills as was the price of rice. The average price difference for the period 1964/65 to 1970/71 between these two regions was about Rs 0.30 per kilogram for maize and Rs 0.35 per kilogram for rice. Since 1968/69, the range of maize price difference between the eastern and the western Hills has been narrowed down to Rs 0.15 to Rs 18. The better crop situation and the transportation improvement in the western Hills might be the cause of narrowing down the difference.

In the valley of Kathmandu, the price of maize has had a declining trend since 1967/68. The major factor for the moderate price level, which was below the national average, was that maize produced in surrounding districts such as Kavreplanchoke, Makwanpur and Chitwan was also marketed in the Valley. Chitwan and Makwanpur, respectively, are the largest maize producing districts in Nepal and have the largest surplus. Maize production in the Kathmandu Valley and the other surrounding districts is increasing because of extensive use of hybrid

maize seeds called Rampur and Khumal Yellow (hybrid maize named after maize research centres), increasing use of chemical fertilizers, and improvement in cultural practices in recent years. Its production in the Valley was 45,000 metric tons in 1969/70, which was about 60 percent higher than production in 1967/68.

Wheat and Wheat Flour Price Movements

Wheat is the second most important cereal crop in South Asia. In the 1960's, particularly in the latter part, South and Far East Asia experienced encouraging increases in grain production. The rate of increase in wheat production was more encouraging than the increase in rice production. Rice production in India was increased by 5.2 percent, whereas wheat production increased by 62 percent during the period 1964/65 to 1969/70.[1] During that period, wheat (including barley) production increased by 80 percent in Nepal.[2] This tremendous increase in wheat production naturally accounts for the decline in the price of wheat and wheat flour after 1967/68.

Wheat production increased by 190 percent in the Tarai during the period 1964/65 to 1969/70. This is one of the reasons for the lowered price level of wheat grain (Table 3.9). Still the price was higher in the eastern Tarai than in the Kathmandu Valley and the western Tarai. Although in percentage terms the Tarai had a substantial increase

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[1] William J. Staub and Melvin G. Blase, "Genetic Technology and Agricultural Development," Science, Vol. 173 (July, 1971).

[2] Pushpa R. Mathema, A Preliminary Study on Market Prospect for Nepalese Wheat, EAPD Staff Paper No. 8 (Kathmandu: Ministry of Food and Agriculture, 1972).

TABLE 3.9

REGIONAL CONSUMER PRICE OF WHEAT (GRAIN), NEPAL

Regions	1967/68	1968/69	1969/70	1970/71
		(Rs/kg)		
Kathmandu	1.43	1.17	0.96	n.a.
E. Tarai	1.83	1.70	1.51	1.62
Biratnagar	2.10	2.11	1.70	1.90
Bhadrapur	1.80	1.95	1.91	1.90
Rajbiraj	1.93	1.52	1.43	1.50
Gour	1.75	1.60	1.26	1.50
Birjung	1.58	1.30	1.24	1.29
W. Tarai	1.80	1.25	1.18	1.24
Bhairwa	2.18	1.41	1.37	1.39
Nepaljung	1.91	1.20	1.13	1.22
Kailali	1.31	1.13	1.03	1.12
E. Hills	n.a.	n.a.	n.a.	n.a.
Illam	n.a.	n.a.	n.a.	n.a.
Dhankuta	n.a.	n.a.	n.a.	n.a.
W. Hills	2.39	1.80	1.62	1.63
Palpa	2.06	2.00	1.62	1.75
Pokhara	2.16	1.69	1.62	1.61
Doti	3.02	2.11	1.65	1.62
Baitadi	2.33	1.40	1.58	1.55

SOURCE: Information from Research Department, Nepal Rastra Bank, Kathmandu, Nepal.

TABLE 3.10

CONSUMER PRICES OF WHEAT FLOUR, NEPAL

Year	Nepal	Kathmandu	East Tarai	West Tarai	East Hills	West Hills
			(Rs/kg)			
1961/62	1.14	0.90	0.97	1.27	1.26	1.17
1962/63	0.96	0.93	1.03	1.11	1.16	0.93
1963/64	1.17	1.04	1.03	1.37	1.31	1.12
1964/65	1.79	2.03	1.53	1.72	1.87	2.09
1965/66	2.25	2.39	2.07	2.02	2.78	2.47
1966/67	1.77	1.79	1.62	1.57	1.47	2.42
1967/68	2.35	2.29	1.99	1.97	2.45	3.11
1968/69	2.16	1.95	1.93	1.70	3.16	2.58
1969/70	1.88	1.93	1.62	1.57	2.48	2.13
1970 71	1.90	1.86	1.62	1.68	2.29	2.03

SOURCE: Information from Research Department, Nepal Rastra Bank, Kathmandu, Nepal.

in wheat, the volume of production increase was low. The highest level of production increase was in the Kathmandu Valley; wheat production went up from 9,000 metric tons in 1965/66 to 30,000 metric tons in 1969/70. This was one of the factors contributing to the decline of prices of wheat and wheat flour in Kathmandu.

There was a wide difference in the district wheat price situation. The price was lowest in Kathmandu and the price in Bhadrapur (eastern Tarai) was highest for the year 1969/70. Even within a region, such as the eastern Tarai, the inter-district price differences were very wide; the price was Rs 1.24 per kilogram in Birjung and it was Rs 1.91 per kilogram in Bhadrapur. Generally, wheat grain prices have decreased more than wheat flour prices since 1968/69.

Annual Wheat Flour Price Movements

In the western Hills, the price of wheat flour was generally not as high as that of rice and maize, though wheat consumed in this region was more than in any other region of the country (Table 3.10). The major reason was that wheat was produced in adequate amounts; the production of wheat in this region constituted 40 percent of the national production in 1969/70.[1] The Tarai region had only an insignificant amount of wheat production prior to 1967/68, and a substantial proportion of the wheat flour imported from India went to the Tarai.

The price indices of wheat flour for Kathmandu, and the eastern and western Hills were 207, 181 and 174, respectively, in 1970/71. The

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[1] Pushpa R. Mathema, A Preliminary Study on Market Prospects for Nepalese Wheat, EAPD Staff Paper No. 8 (Kathmandu: Ministry of Food and Agriculture, 1972).

flour price indices for the eastern and western Tarai were 167 and 132. Thus, the western Tarai had experienced only a moderate increase of price during the 1960's (Appendix XI).

The highest rate of increase of prices occurred in all the regions in the year 1964/65. The flour shortage continued till 1967/68. Speculative activities in the major cities and towns were high. Import licenses were issued to the few traders and they had adequate control over the quantity supplied in the markets; therefore, they were able to raise prices. However, after 1967/68 the indices went down because of a tremendous increase of wheat output in the major grain producing areas of the Tarai, the Hills and the Kathmandu Valley.

Correlation of Regional Prices

Prices of wheat flour in Kathmandu were more closely related to prices in the Tarai, particularly in the eastern Tarai. The correlation coefficient between prices in the eastern Tarai and Kathmandu was 0.96. Prices of flour in the Hills were more positively correlated with prices in the Tarai than with the prices in the Hills themselves. Correlation coefficients between prices in the western Tarai and the western Hills, and the eastern Tarai and the eastern Hills were 0.90 and 0.88, respectively (Table 3.11).

Price Differences Between Wheat Flour and Grain

Prices of wheat grain were very low in the Kathmandu Valley because this region had a surplus production of wheat grain and it was exported. But prices of flour were not as low as prices of wheat grain in Kathmandu; they were higher than in the Tarai. Flour was also imported from India. As cost of transportation to Kathmandu was higher than to the Tarai, prices of flour could be high in the Kathmandu Valley.

TABLE 3.11

CORRELATION OF PRICES OF WHEAT FLOUR IN NEPAL AND REGIONS

	Nepal	Kathmandu	East Hills	West Hills	West Tarai	East Tarai
Nepal	1.000					
Kathmandu	0.967	1.000				
E. Hills	0.882	0.811	1.000			
W. Hills	0.967	0.926	0.769	1.000		
W. Tarai	0.952	0.955	0.782	0.897	1.000	
E. Tarai	0.984	0.960	0.882	0.947	0.929	1.000

On the other hand, prices of wheat grain were higher in the Tarai than in Kathmandu. Part of the grain requirement for the Tarai was met through supplies from the Kathmandu Valley and the Rapti Valley. However, the differences between prices of grain and flour in the Tarai were not as wide as in Kathmandu (Table 3.12).

There was a wide margin of 80 to 100 percent between the consumer prices of wheat grain and flour in Kathmandu. The major factor responsible for such a wide difference could be an inadequate quantity of supply of fine flour. The major proportion of imported flour was absorbed by big hotels and bakery factories. Hence there was usually a shortage of flour for traditional bread preparation since the quantity of flour demanded by traditional bread consumers was high in Kathmandu.

TABLE 3.12

PRICE DIFFERENCES BETWEEN WHEAT FLOUR AND WHEAT GRAIN BY REGIONS, 1969/70

Regions	Wheat Flour	Wheat Grain	Difference
		(Rs/kg)	
Kathmandu	1.93	0.96	0.97
E. Tarai	1.62	1.51	0.11
W. Tarai	1.57	1.18	0.39
E. Hills	2.48	n.a.	--
W. Hills	2.13	1.62	0.51

SOURCE: Information from Research Dept., Nepal Rastra Bank, Kathmandu.

Variation and Instability of Prices

Variation of Prices from the Mean

The measurement of relative dispersion of prices shows that the divergence of wheat flour price from the mean is higher than the relative variation of rice price from the mean (see Table 3.13). Substantially higher coefficients of variation of wheat price were observed in Kathmandu, and the eastern and western Hills. The highest coefficient was 35.7 percent in the western Hills, and the lowest figure was 18.0 percent in the western Tarai.

In contrast to the relative variation of wheat prices, the rice price variation from the mean was the highest in the western Tarai, 29.3 percent. The lowest coefficient of variation of rice price was 20.4 percent, which was observed in the western Hills.

TABLE 3.13

COEFFICIENTS OF VARIATION OF PRICES[1]

Item	Mean Price (Rs/kg)	Standard Deviation (Rs/kg)	Coefficient of Variation (Percentage)
Cereal			
Nepal	1.443	0.3384	23.5
Rice			
Nepal	1.626	0.3848	23.7
Kathmandu	1.634	0.3369	20.6
E. Hills	1.602	0.4567	27.5
W. Hills	1.955	0.3989	20.4
W. Taral	1.406	0.4122	29.3
E. Taral	1.476	0.3642	24.7
Wheat Flour			
Nepal	1.733	0.4875	28.1
Kathmandu	1.711	0.5527	32.3
E. Hills	2.023	0.7065	34.9
W. Hills	2.005	0.7149	35.7
W. Taral	1.598	0.2882	18.0
E. Taral	1.541	0.4082	26.5
Paddy			
Nepal	0.943	0.2268	24.1
E. Hills	1.021	0.2740	26.8
W. Hills	1.247	0.3004	24.1
W. Taral	0.743	0.2221	29.9
E. Taral	0.837	0.2066	24.7
Maize			
Nepal	1.733	0.4875	28.1

[1] The coefficient of variation is estimated as follows: $V = \frac{d}{\bar{X}}$; $\bar{X}$ = Mean and d = standard deviation.

The relative vairation of rice price was less than the variation of price of paddy. The higher estimated coefficients of variation of various cereal grain prices may reflect the possibility of greater instability of prices.

Instability of Prices Around the Trend

The estimated price instability coefficients are given in Table-3.14. The price instability was in percentage around the estimated semilogarithmic trend. The coefficients show that maize price instability was very high compared to the price instability of other grains at the national level. The wheat price instability coefficients were greater than the rice price instability coefficients except in the western Tarai.

At the regional level, the highest rice price instability coefficient, 13.8 percent, was estimated for the western Tarai, and the lowest figure, 5.7 percent, was calculated for the Kathmandu Valley. On the other hand, a very high wheat price instability coefficient was estimated for the Valley, and a low figure was observed for the western Tarai. As rice is the main crop and as its price is more unstable in the western Tarai, a higher percentage of stock of rice might be required if a stabilization programme such as the operation of buffer stock is undertaken.

In this chapter, the level of regional price differences, variation in the rate of increase of prices of various grains in the different regions, correlation among prices and the instability of prices around the trend are described. The theoretical factors affecting price and the explanation of the factors associated with the prices of cereal grains in Nepal are dealt in detail in the next chapter...

TABLE 3.14

INSTABILITY COEFFICIENTS OF PRICES OF GRAINS BY REGIONS, 1961/62 - 1970/71[1]

Regions	Rice	Wheat Flour	Maize	Cereal Grain
	(Percent)			
Nepal	10.59	17.36	19.14	12.84
Kathmandu	5.74	22.50	n.a.	n.a.
E. Hills	11.60	19.98	n.a.	n.a.
W. Hills	11.92	24.84	n.a.	n.a.
W. Tarai	13.78	12.03	n.a.	n.a.
E. Tarai	10.90	16.82	n.a.	n.a.

1. The instability coefficient is estimated as follows: First, the least squares trend of price is calculated with log $Y = B_0 + B_1 (T) + e$

where:

Y = observed prices, T = time.

Second, P, the percentage deviation of the actual price from the trend, is calculated. Third, the instability coefficient figure is derived with the following formula.

$$\frac{\sum_{i=1}^{n} P}{N}$$

N is number of observations.

The above method (average percentage deviation from the trend) is simple, and also corrects the trend. However, the method has one important deficiency; it may exaggerate instability if more than one trend is present.

CHAPTER IV

FACTORS AFFECTING PRICES OF CEREAL GRAINS

Theoretical Factors Associated With Price

In the initial stages of economic growth, prices of most agricultural products, particularly food grains, may rise faster than nonagricultural prices if the imbalance between the increase in the quantity demanded and supplied continues. As income elasticity of demand for food grains is higher in less developed countries like Nepal, its demand may increase at a higher rate because of a rise in the level of income due to the higher rate of increase of government and private sector investment, and the higher rate of population growth, particularly in the nonfarm sectors. On the other hand, a long period of time may be required to achieve higher rates of increase in production due to time lag involved in research, because of the necessity of decision-making of a larger mass of farmers, and the need for extensive development funds to initiate growth in the agricultural sector. If a substantial amount of foreign exchange is available, the shortage of grains may be met through import.

The major factors associated with the change in price of a product are quantity demanded and supplied. Demand represents willingness of the consumers to buy under certain conditions, and no actual transaction is necessary for its existence.[1] As already stated, the increase

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[1] F. L. Thomsen, Agricultural Prices (New York: McGraw-Hill Book Company, Inc., 1936).

in demand for a product is primarily caused by an increase in population and income. Price rise, however, does not necessarily indicate the increase in demand only; it rises because of the inadequate quantity of supply of the product. If the rate of growth of demand is higher than the growth of supply, the price of the commodity may rise.

There are interrelationships between price, quantity demanded, and quantity supplied. Supply represents the willingness and ability to sell under the given specified conditions. Over longer periods of time, the supply becomes a matter of producers' willingness to produce rather than willingness to sell. Variation in quantities produced at different prices are the results of changes in the output of existing producers, and the entrance and withdrawal of new and old producers.[1]

Whenever the supply and the demand increase, the quantity to be sold and purchased increases, but the price may remain stable, fall or rise, depending upon the extent of change in demand and supply. Under ceteris paribus conditions, the higher rate of increase of demand relative to increase in the rate of supply leads to increase in price, and the magnitude of increase depends upon the gap between the rate of increase of demand and supply, and the elasticity of price with respect to change in the demand and supply.

The changes in prices of grains such as rice are not only associated with the change in the balance between supply and demand but also with the change in the general price level, prices of substitutes and complementarities, prices in exporting or importing countries, and

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[1] Ibid., p. 40.

fiscal and monetary measures such as change in the level of taxes, change in the foreign exchange rate, change in money supply, etc. In spite of an adequate supply situation in a country, prices may also continue to rise due to the rise of prices in the importing countries, or because of a supply of money in excess of that required according to the rate of economic growth and increasing monetization of the economy.

In the case of commodities having substitutes, their prices may not increase if the other commodities are perfect substitutes and available at relatively cheaper prices. In a normal situation, perfect substitutes are hard to find and, therefore, the price of the commodity in question may rise. Cereal grain is the staple food and has no perfect substitute in an emerging country like Nepal. To some extent, potatoes may be a substitute in the potato season but their importance is very minimal on a year-round basis.

In the cereal group, various grains can be substituted for one another. But the possibility of substitution depends upon and varies according to place, time, form and price. Maize is a substitute for rice in the Hills, but not in the Tarai, mainly because of taste and habit. However, rice is not only the main staple cereal grain for all nonfarm consumers in all regions, except in the trans-Himalayan belt, but also the most important source of income for farm families. Rice can be substituted for wheat and maize. Therefore, its price may have a major influence over the price of maize and wheat at the national level. Even at the regional level, its prices can play an important role. In the case of the western Hills, the maize crop is the first crop, and wheat is also equally important; it is expected that the total volume

of wheat and maize production may have an influence over the price of rice. Thus, it is also assumed that there is a close interrelationship between prices of rice and maize at least in the Hills.

Factors Affecting Demand for Cereal Grains

Population

The first important factor affecting demand for grains in Nepal is population. Demand depends on the size of population, its composition, distribution of sex, type of occupation of the people involved, and their average height and weight. Population had increased at the rate of 1.8 percent per annum. A higher rate of increase was 4 percent per annum in the western Tarai (Table 4.1). The lowest increase was 1 percent per year in the western Hills. The Kathmandu Valley had an annual percentage increase of 2.4 percent. The important feature is that a very high rate of population has been experienced in the rice consuming regions. The basic causes of the higher rate of increase in population, particularly in the western Tarai, are migration from the Hills, the eradication of malaria, and increases in other public health measures.

The population variable is taken as an independent variable to represent a factor affecting demand in the statistical analysis of prices of grains at the national and regional level (in Chapter V). It is expected that the population variable will have a positive effect on prices. This variable is expected to be an important factor leading to rises in prices, especially of rice in the western Tarai, the eastern Tarai and the Kathmandu Valley. However, its influence on national aggregate prices of grains and on prices in the Hills region may not be a significant one.

TABLE 4.1

POPULATION IN NEPAL, 1961/62 TO 1970/71[1]
(BY REGIONS)

Year	East Hills	West Hills	East Tarai	West Tarai	Inner Tarai	Kathmandu Valley	Nepal
			('000)				
1961/62	1,910	3,681	2,274	699	547	471	9,582
1962/63	1,934	3,718	2,336	727	557	482	9,754
1963/64	1,958	3,755	2,400	756	567	494	9,930
1964/65	1,982	3,793	2,466	786	578	505	10,110
1965/66	2,007	3,831	2,533	818	589	517	10,295
1966/67	2,032	3,869	2,603	850	599	530	10,483
1967/68	2,057	3,909	2,674	884	611	543	10,678
1968/69	2,083	3,947	2,747	920	622	556	10,875
1969/70	2,108	3,986	2,823	957	633	750	11,077
1970/71	2,129	4,033	2,900	995	645	587	11,289

[1] 1960/61 and 1970/71 population statistics are census figures. The rest are estimated at the annual average rate of 1.8 percent.

SOURCE: Information from Central Bureau of Statistics, Kathmandu, Nepal.

Income

Another important factor is income. As stated in Engel's Law, a higher percentage of income is spent on food at a low level of income. Per capita income at constant price (1964/65) was Rs 565.00 and, at current price (1970/71), Rs 804.00. The gross domestic product was Rs 6,382 million (constant price) and Rs 9,077 million in 1970/71 (Table 4.2).

The increase of per capita real income was only 4 percent in nine years, though the income at current price increased by 109 percent. The real income elasticity of demand for food is assumed to be around 0.75, and the real income elasticity of demand for cereal grains only is estimated at 0.6.[1] Though there has been no significant increase in real income, the change in income distribution might have affected the level of demand. But it is difficult to point out specifically because of lack of information.

Per capita real income is used to estimate the quantity of cereal grains demanded. The prices used in econometric analysis are undeflated prices. Prices are not deflated because of the lack of a national general consumer price index and other appropriate variables that can be used as deflators. Whenever quantity of cereal grain demanded as a variable is not used in the models, income per capita at

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[1] Different figures for income elasticity of demand for food have been used in the projections of demand for food in Nepal. However, those figures do not vary much. See T. Sakiyama, Evaluation of Third Plan Agricultural Performance, Nepal (Kathmandu: Ministry of Food and Agriculture, 1972).

TABLE 4.2

ESTIMATED GROSS DOMESTIC PRODUCT, NEPAL

Year	Total G.D.P. (Million Rs)	Per Capita G.D.P. (Rs)	Total G.D.P. (Million Rs)	Per Capita G.D.P. (Rs)
	At Current Prices		At Constant Prices ('64-65)	
1961/62	3,682	384	5,236*	546
1962/63	4,000*	410	5,340*	547
1963/64	4,600*	463	5,447*	549
1964/65	5,620	554	5,602	554
1965/66	6,907	671	5,994	582
1966/67	6,415	612	5,906	563
1967/68	7,174	672	5,943	557
1968/69	7,986	734	6,208	571
1969/70	8,796	794	6,386	577
1970/71	9,077	804	6,382	565

* Estimation based on the average annual percentage increase of G.D.P. at constant prices, and increase in price reported in the HMG/Nepal National Planning Council, Third Plan (Kathmandu: NPC, 1966), p. 10.

SOURCE: Information from Central Bureau of Statistics, Kathmandu, Nepal.

current prices is introduced as a variable representing demand for cereal grains. Per capita income data at regional levels are not available. Therefore, the national per capita income at current prices as proxy variable is used in the analysis of factors affecting prices at the regional level. A positive influence of the income variable on prices is expected.

Price of Substitutes and Complementarities

As already stated, rice has no close substitute at the national level. At the regional level, particularly in the Hills, maize and wheat are substitutes. In the Tarai, maize and wheat are not consumed as in the Hills. Recently, with the increasing production of wheat in the country, its price is falling, and its consumption in the Kathmandu Valley is increasing, but still, on the basis of its level of production as compared to rice, it has no significant place.

Wheat flour has complementarities. Sugar and ghee (clarified butter) are particularly good complementarities. The increase in price of sugar and ghee leads to decreases in the quantity of sweet products and confectionary demanded, whereas rice and maize do not have close complementary products.

Price of rice is expected to be the important variable positively affecting prices of wheat and maize at the national level and in the Tarai regions. On the other hand, the total production of maize and wheat in the Hills, particularly the western Hills, is expected to be a significant variable in affecting price of rice.

At the regional level, the prices of rice in the eastern and western Tarai are expected to be the most important variables affecting prices of rice in the eastern and western Hills, respectively. However,

the price of wheat flour in the Tarai is not expected to be a significant variable in influencing prices of wheat flour in the Hills. Price data on rice, maize and wheat flour at the national and regional levels are reported in Chapter III.

Foreign Demand

The export demand depends upon the level of income and grain production in the importing country, the magnitude of price differences between export and import prices, tariff and foreign trade regulations of the countries, the stock of grains with the Food Corporation of India, the amount of grains imported into India from other exporting countries, and the supply and demand situations in the exporting country.

The foreign demand for rice may influence the domestic price level through increase in the total demand, particularly in the Tarai. In analysing the factors affecting price, certain factors have to be introduced to represent the changes in foreign demand. It is difficult to obtain a satisfactory measure which directly reflects the foreign demand conditions. However, the actual quantity exported, prices, and the gap between domestic demand and supply in the importing country can be taken into account as the measures for representing the foreign demand.

A priori, it may be difficult to ascertain whether the price becomes high in the Nepalese market when the export demand is high, or that export demand increases when the domestic price is low. In other words, the foreign demand may change as the result of the change in price of the commodity in the domestic market.

Nepal does not have a record of the actual quantity exported. Through 800 kilometers of open border rice is easily smuggled. It is estimated unofficially that equal amounts of grain are legally and illegally exported.[1] Therefore, use of export quantities recorded in the custom points may not give a reliable picture. Data with respect to the gap between supply and demand in the northern states of India are not available. It is possible that there can be a close association between prices in Nepal and the bordering states of India. However, these data are not available. So all-India price indices of rice and wheat are taken into account as a measure to represent the export demand, and with their introduction in the econometric analysis, the measurement of the nature and extent of association of prices between the two countries can also be examined.

Factors Affecting Supply

The major factors affecting supply are the level of domestic production, net trade, stock and carryover of grains in the country. The trend of cereal grain production during the various economic plan periods has already been given in Chapter I.

The major crop, rice (dehusked paddy), contributed 58.21 percent to the total cereal production. The second crop is maize, contributing 33.88 percent; wheat is the third crop with 8 percent contribution (see Table 4.3 and 4.4).

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[1] T. Sakiyama, Evaluation of Third Plan Agricultural Performance (Nepal: Ministry of Food and Agriculture, 1972), p. 100.

TABLE 4.3

PRODUCTION OF EDIBLE CEREAL GRAINS AVAILABLE FOR USE[1]

Year	Rice	Wheat	Maize	Total
1961/62	1,264.8	132.9	827.4	2,225.1
1962/63	1,264.8	133.9	817.7	2,216.4
1963/64	1,265.4	134.8	823.5	2,223.7
1964/65	1,320.6	122.2	828.4	2,271.2
1965/66	1,324.2	142.6	830.3	2,297.1
1966/67	1,204.2	154.2	798.3	2,156.7
1967/68	1,330.2	184.3	848.8	2,363.3
1968/69	1,393.2	220.2	873.0	2,486.4
1969/70	1,445.4	235.7	892.4	2,573.5
1970/71	1,388.4	188.8	808.0	2,385.2

[1] Rice conversion rate is 60 percent; wheat and maize, 97 percent.

SOURCE: Information from Ministry of Food and Agriculture, Kathmandu, Nepal.

TABLE 4.4

PERCENTAGE CONTRIBUTION OF VARIOUS EDIBLE CEREAL GRAINS TO TOTAL PRODUCTION

Year	Rice	Wheat	Maize	Total
1961/62	56.84	5.97	37.18	100.0
1962/63	57.07	6.04	36.89	100.0
1963/64	56.91	6.06	37.03	100.0
1964/65	58.15	5.38	36.47	100.0
1965/66	57.65	6.21	36.15	100.0
1966/67	55.84	7.15	37.01	100.0
1967/68	56.29	7.80	35.92	100.0
1968/69	56.03	8.86	35.11	100.0
1969/70	56.16	9.16	34.68	100.0
1970/71	58.21	7.92	33.88	100.0

SOURCE: Table 4.3

The eastern Tarai (excluding inner Tarai) alone contributes 34 percent to the total national production and the western Tarai contributes 18 percent. Together it comes to 52 percent. Western and eastern Hills combined had 35 percent of the grain production. In the Tarai and the Kathmandu Valley, production increased, but in the western Hills, the level of production is almost constant, and in the eastern Hills, it has decreased (see Table 4.5).

There is no data on stock and carryover. Export and import situations have been described in Chapter I. In the following section, supply of cereal grains, rice, maize and wheat for domestic use are estimated at the national level. Because of lack of adequate data, particularly on interregional flow of grains, the volume of grains available for domestic use in the different regions are not estimated. Quantity of domestic demand for aggregate cereal grains and rice are estimated on the basis of change of per capita gross domestic product at constant prices and rate of population growth.

Availability of Grains for Domestic Use

The estimated net availability of cereal grains (rice, maize and wheat) for the period 1961/62 to 1964/65 remained almost constant. However, the continuous growth of population and increase of exports led to a decrease in per capita availability for domestic use--from 186 kilograms in 1961/62 to 180 kilograms in 1964/65. After 1966/67, there was an increase in availability of grains and it reached 191 kilograms per person per year in 1969/70. The per capita availability declined substantially in 1970/71 due to a decline in production (Table 4.6).

TABLE 4.5

TOTAL CEREAL GRAINS PRODUCTION, 1961/62 TO 1970/71, BY REGIONS[1]

Year	East Hills	West Hills	Kathmandu Valley	East Tarai	West Tarai	Inner Tarai	Nepal
			('000 Metric Tons)				
1961/62	357.0	530.2	48.0	784.6	337.6	197.4	2,254.8
1962/63	359.0	530.0	52.8	768.6	342.6	192.8	2,245.8
1963/64	368.6	495.8	55.0	795.6	327.8	210.6	2,253.4
1964/65	361.8	526.8	49.4	820.8	349.2	192.6	2,300.6
1965/66	349.9	533.4	60.7	838.0	347.4	197.8	2,327.2
1966/67	240.7	484.8	63.9	799.4	311.4	182.0	2,082.2
1967/68	340.5	557.6	91.3	812.0	371.8	222.0	2,395.2
1968/69	227.6	540.6	113.0	891.6	418.4	229.0	2,240.2
1969/70	306.0	526.6	124.6	965.4	458.4	226.4	2,607.4
1970/71	302.2	536.6	120.6	813.2	430.2	213.4	2,416.4

[1] Including rice, maize and wheat.

SOURCE: Information from Ministry of Food and Agriculture, Kathmandu, Nepal.

TABLE 4.6

ESTIMATED PER CAPITA AVAILABILITY OF CEREAL GRAINS, NEPAL

Year	Production[1]	After 15 Percent Reduction for Seeds, Wastages[2]	Export	Import	Net Availability	Population	Per Capita Availability
			('000 M.T.)			(000)	(kg.)
1961/62	3,098	1,916	133	4	1,787	9,582	186
1962/63	3,089	1,909	101	5	1,813	9,754	186
1963/64	3,097	1,916	115	6	1,807	9,930	182
1964/65	3,181	1,956	144	3	1,815	10,110	180
1965/66	3,210	1,976	63	3	1,916	10,295	186
1966/67	2,989	1,859	144	2	1,717	10,483	164
1967/68	3,282	2,037	105	2	1,934	10,678	181
1968/69	3,449	2,142	112	2	2,032	10,875	187
1969/70	3,573	2,218	103	2	2,117	11,077	191
1970/71	3,332	2,049	110	2	1,941	11,289	172

[1] Production includes paddy, wheat and maize.

[2] Includes rice, wheat and maize. Paddy is converted into rice at 60 percent rate.

SOURCE: Ministry of Food and Agriculture, Annual Reports, 1968/69 and 1969/70 (Kathmandu: Ministry of Food and Agriculture, 1969 and 1970), Table 4.2.

In both cereal grain and rice availability estimations, stock and carryover are not taken into account. Per capita availability of rice had more fluctuating tendency than the per capita availability of aggregate cereal grains (Table 4.7). There had been no substantial increase in per capita availability of rice during the 1960's. In the statistical analysis of factors affecting national cereal grains and rice prices (Chapter V), net availability is used as an independent variable. In the case of regional price analysis, the volume of production of respective crops is taken into account to represent supply situation.

It is assumed that the volumes of availability of aggregate cereal grains and rice are not more important variables than are the demand factors and price of rice in India in affecting prices of cereal grains and rice in Nepal. The volume of production of wheat in Nepal is not a significant variable in affecting wheat flour price. However, it is expected that wheat production is an important variable at the regional level, particularly in the Hills.

Difference Between Quantity Available and Demanded

The estimations of quantity of cereal grains and rice demanded in Nepal were based on the assumption that aggregate demand for cereal grains and rice was equal to the net availability of grains for domestic use in 1961/62. For the rest of the years, the estimated quantity demanded was based on rate of growth of population and rate of growth of income. As stated earlier, coefficients of income elasticity of demand for cereal grains and rice are 0.6 and 0.5, respectively. Except for the year 1969/70, the difference between cereal grain quantity demanded and available was increasing. It is expected that this increasing difference would have a positive effect on their prices.

TABLE 4.7

ESTIMATED PER CAPITA AVAILABILITY OF RICE, NEPAL

Year	Paddy Production	After 15 Percent Reduction	Converted into Rice[1]	Export	Import	Net Availability	Population	Per Capita Available
				('000 M.T.)			(000)	(kg.)
1961/62	2,108	1,792	1,075	118	--	957	9,582	99.9
1962/63	2,108	1,792	1,075	88	--	987	9,754	101.2
1963/64	2,109	1,793	1,076	99	--	977	9,930	98.4
1964/65	2,201	1,871	1,123	122	--	1,001	10,110	99.0
1965/66	2,207	1,876	1,123	50	1	1,074	10,295	104.3
1966/67	2,007	1,706	1,024	122	--	902	10,483	86.0
1967/68	2,217	1,884	1,131	91	--	1,040	10,678	97.4
1968/69	2,322	1,974	1,184	102	--	1,082	10,875	99.5
1969/70	2,410	2,049	1,229	91	--	1,138	11,077	102.7
1970/71	2,305	1,959	1,176	98	--	1,078	11,289	95.5

[1] Conversion ratio 1:0.6. -- less than 500 metric tons or nil.

SOURCE: Ministry of Food and Agriculture, Annual Report, 1969/70 (Kathmandu: Ministry of Food and Agriculture, 1970); Central Bureau of Statistics, Population Census 1961 and 1971 (Kathmandu: CBS, 1961 and 1971).

The estimated quantity of rice demanded was increasing. However, the quantity available for domestic use in some years was found to be greater than the estimated quantity demanded (Tables 4.8 and 4.9). Generally, it is expected that, when volume of supply lags behind quantity demanded, price will rise.

Cereal Grain Prices in India

Wholesale price of rice in India increased by 18.5 percent in 1963/64 as compared to the 1961/62 level. A substantial increase in prices was observed during 1966/67 and 1967/68. In 1967/68, the rice price index reached 200.5. Since 1968/69, the indices have been lower than in 1967/68 (see Table 4.10).

It is expected that prices of rice in Nepal and the Tarai are significantly associated with the price of rice in India. This explanatory variable is expected to be the important positive factor for changes in prices, particularly in the Tarai regions. Wheat flour is imported from India, but the amount is not significant. Therefore, wheat price movement in India is not expected to be a significant variable associated with wheat flour price in Nepal and the Tarai.

The factors mentioned in the preceeding sections are some of the important variables representing demand and supply of grains. In addition to these factors, the change in the movements of prices of grains in India may also affect prices in Nepal. In the next chapter, these economic variables are used in the statistical analysis of factors affecting prices of grains at the national and regional levels of Nepal.

TABLE 4.8

DIFFERENCE BETWEEN CHANGES IN QUANTITY OF CEREAL GRAINS DEMANDED AND AVAILABLE FOR DOMESTIC USE, NEPAL[1]

Year	Population ('000)	Income Per Capita at Constant Prices, 1964 (Rs)	Estimated Quantity Demanded	Estimated Availability for Domestic Use ('000 M.T.)	Difference Between Quantity Demanded and Available
1961/62	9,582	546	1,787	1,787	0
1962/63	9,754	547	1,821	1,813	8
1963/64	9,930	549	1,859	1,807	52
1964/65	10,110	554	1,902	1,825	77
1965/66	10,295	582	1,994	1,916	78
1966/67	10,483	563	1,991	1,727	264
1967/68	10,678	557	2,014	1,934	80
1968/69	10,875	571	2,081	2,032	49
1969/70	11,077	577	2,131	2,117	14
1970/71	11,289	565	2,143	1,941	202

[1] The domestic quantity demanded for the year 1961/62 is assumed equivalent to quantity available for domestic use in 1961/62. For rest of the years, quantity demanded is estimated according to change in population and per capita real income. The income elasticity of demand for cereals is assumed at 0.6.

SOURCE: Tables 4.1, 4.2, and 4.6.

TABLE 4.9

DIFFERENCE BETWEEN CHANGES IN QUANTITY OF RICE DEMANDED AND AVAILABLE FOR DOMESTIC USE, NEPAL[1]

Year	Population	Income Per Capita at Constant Prices, 1964	Estimated Quantity Demanded	Estimated Availability for Domestic Use	Difference Between Quantity Demanded and Available
	('000)	(Rs)		('000 M.T.)	
1961/62	9,582	546	957	957	0
1962/63	9,754	546	975	987	-12
1963/64	9,930	549	995	977	18
1964/65	10,110	554	1,017	1,001	16
1965/66	10,295	582	1,061	1,074	-13
1966/67	10,483	563	1,063	902	161
1967/68	10,678	557	1,076	1,040	36
1968/69	10,875	571	1,109	1,082	27
1969/70	11,077	577	1,135	1,138	-3
1970/71	11,289	565	1,144	1,078	66

[1] The estimated quantity demanded for the year 1961/62 is assumed equivalent to quantity available for domestic use in 1961/62. For the rest of the years, demand is estimated according to changes in population and per capita real income growth. The income elasticity of demand is assumed at 0.5.

SOURCE: Tables 4.1, 4.2, and 4.7.

TABLE 4.10

MOVEMENTS IN WHOLESALE PRICE INDICES, INDIA

Year	Rice	Wheat	Jowar
	(Base Year: 1961/62)		
1961/62	100.0	100.0	100.0
1962/63	105.3	98.4	115.4
1963/64	118.5	105.7	103.4
1964/65	127.3	137.8	165.3
1965/66	136.7	149.2	167.3
1966/67	168.6	177.7	170.9
1967/68	200.5	213.7	197.4
1968/69	196.4	204.3	185.1
1969/70	196.5	214.8	192.4
1970/71	201.0	208.0	190.0

SOURCE: Reserve Bank of India, Report on Currency and Finance, 1969/70 (India: Reserve Bank of India, 1969/70), p. 526; Reserve Bank of India, Bulletin, Vol. 26, Part 1 (1972).

CHAPTER V

STATISTICAL ANALYSIS OF FACTORS AFFECTING CEREAL GRAIN PRICES

In this chapter, the statistical analysis of factors affecting prices of rice, maize and wheat flour at the national level, and rice and wheat flour prices at regional levels, such as in the Kathmandu Valley, the eastern Hills, the western Hills, the eastern Tarai and the western Tarai are carried out. The estimations of relationships between the prices and the factors associated with them would help examine the responsiveness of prices to the changes in the other economic variables such as income, quantity produced, and movement of prices in India. The regional analysis would show the degree of variation in the responsiveness of a product price to changes in demand, supply and other variables in the different regions of Nepal.

Cereal grain price studies have been done in India and Pakistan. A study of food grain price in India showed that the upward trend in prices was largely associated with the supply of money, and that the year-to-year fluctuations in price were caused by fluctuations in production because of weather.[1] The studies on the price of rice indicated that the per capita availability of rice and per capita income were the significant factors affecting its price.[2] However, studies on

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[1] John W. Mellor and Ashok K. Dar, "Determinants and Development Implications of Food Grain Prices in India, 1949-64," Journal of Farm Economics, Vol. 50, No. 4 (1968), pp. 962-974.

[2] NCAER, Structure and Behaviour of Price of Food Grains (New Delhi: National Council of Applied Economic Research, May 1969); R. Thamarajkshi, "Cereal Prices in the Indian Economy," Agricultural Situation in India (Delhi: Directorate of Economics and Statistics, Ministry of Agriculture, August 1971), pp. 303-305.

wheat price in India showed that the wheat production variable was not a significant variable affecting its own price.[1]

The studies on rice price in East Pakistan (now Bengaladesh) indicated that an inadequate supply of rice to meet increasing demand was an important cause of rise in price. There was an instability of prices and the causes for their instability were lack of storage facilities, fluctuations in production and inadequate means of transportation. These studies pointed out that regulation of supply was an important measure for the stabilization of prices.[2]

Econometric Models

Based on the theoretical basis reported in Chapters II and V, various single equation models are prepared to test the relationships of cereal grain, rice, wheat flour, and maize prices in Nepal with selected explanatory variables at the national level. At the regional level, more than one model for the analysis of rice and wheat flour prices are prepared. The econometric analysis of cereal grain and maize

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[1] R. Thamarajkshi, "Determinants of Wheat Price," Agricultural Situation in India (Delhi: Ministry of Food and Agriculture, May 1970), pp. 129-136; NCAER, Structure and Behaviour of Price of Food Grains (New Delhi: National Council of Applied Economic Research, May 1969).

[2] A.F.A. Husain, "Price and Distribution Controls in Pakistan," Pakistan Economic Journal, Vol. XI, No. 2 (June, 1961), pp. 17-25; S. G. Kabir, "A Plan for the Stabilization of Agricultural Prices in East Pakistan," Pakistan Economic Journal, Vol. XII, No. 1 (March, 1962), pp. 79-92; and A.K.M. Ghulam Rabbani and R. C. Repetto, "Food Grains Availability, Money Supply and the Price Level in East Pakistan: Some Simple Econometrics on Short-Term Stabilization Policies," The Pakistan Development Review, Vol. VIII, No. 2 (Sept., 1968), pp. 281-287.

For a detailed literature review on factors affecting cereal grains prices in India and Pakistan, see Appendix XII.

prices are not carried out at the regional level because of lack of adequate time series data. The models used, for example, are of the following forms:

$$P_c = a + b_1 D_c + b_2 S_c + b_3 I_r + \ldots + e$$

$$\text{Log } P_c = \log a + b_1 \text{ Log } D_c + b_2 \log S_c + b_3 \log I_r + \ldots + e$$

in which:

P_c = retail price of cereal grain, D_c = estimated quantity of cereal grain demanded, S_c = estimated availability of cereal grain for domestic use, I_r = price of rice in India, e = error term, and a, b_1, b_2 and b_3 are unknown parameters to be estimated.

The general graphic models for cereal grain, rice, wheat flour and maize at the national level are presented in Figure 5.1 to 5.4. The broken lines in the figures show the minor path of influence and the unbroken ones show the major path of influence. These graphic models show the interrelationships between price, demand and supply variables.

Analytical Techniques

The least squares technique is widely used in agricultural price analysis. Whenever a set of variables can be distinctly classified into dependent and independent variables, the least squares technique may give unbiased results. However, if one or more variables appear as dependent variables in some relationships and as independent variables in other relationships, then a simultaneous equation technique is more appropriate. Reduced form estimation, derivable from the structure of a simultaneous equation system, has an important role in

FIGURE 5.1

DEMAND, SUPPLY AND PRICE STRUCTURE FOR CEREAL GRAINS, NEPAL

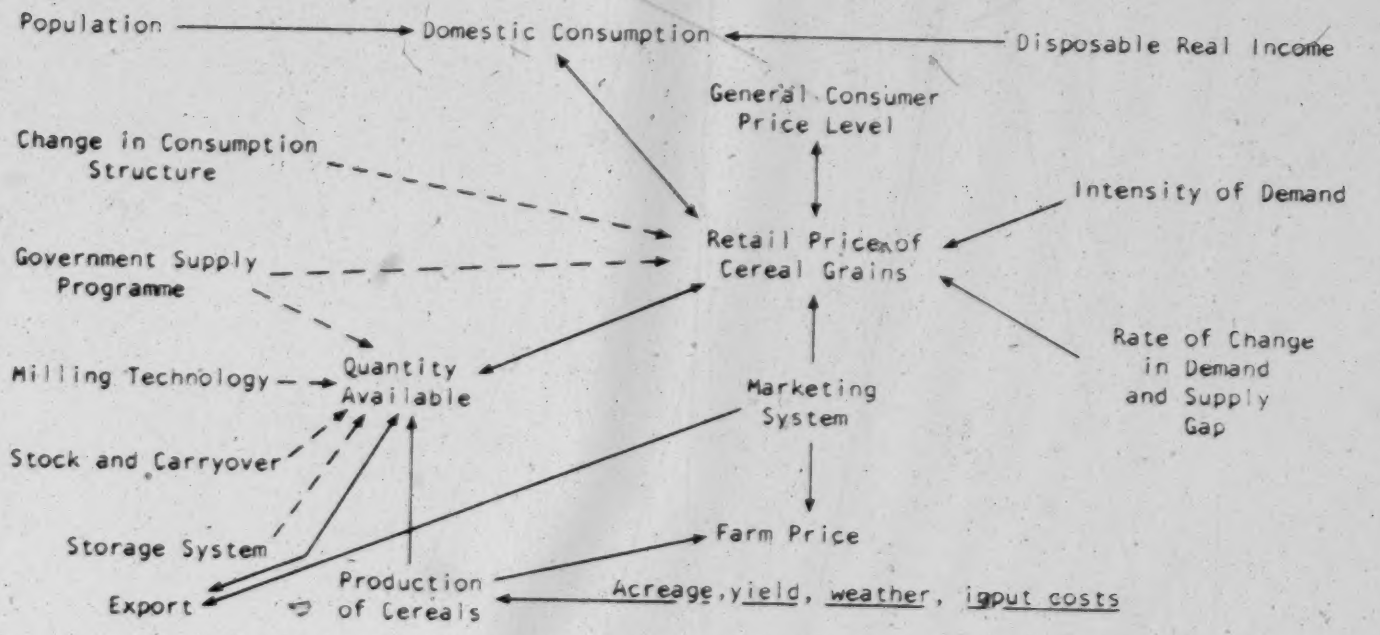


FIGURE 5.2

DEMAND, SUPPLY AND PRICE STRUCTURE FOR RICE, NEPAL

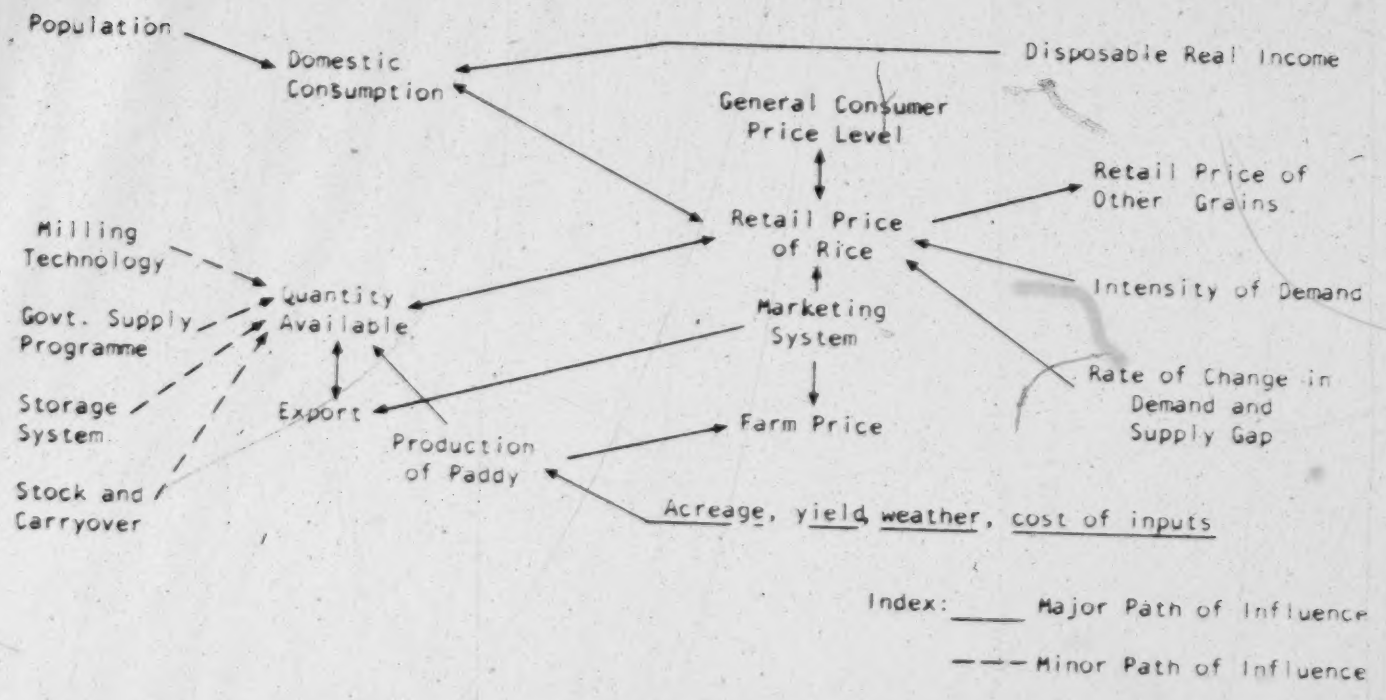


FIGURE 5.3

DEMAND, SUPPLY AND PRICE STRUCTURE FOR WHEAT FLOUR, NEPAL

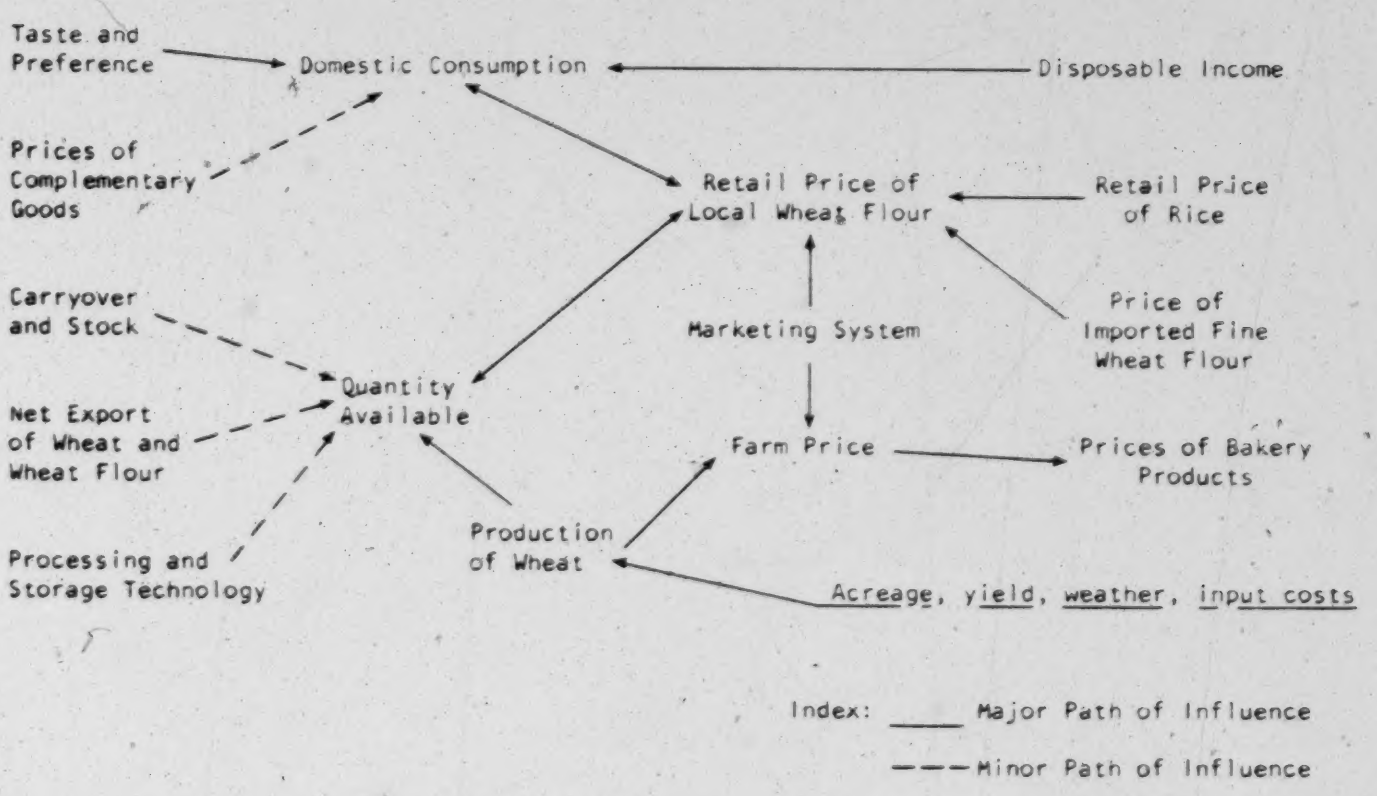
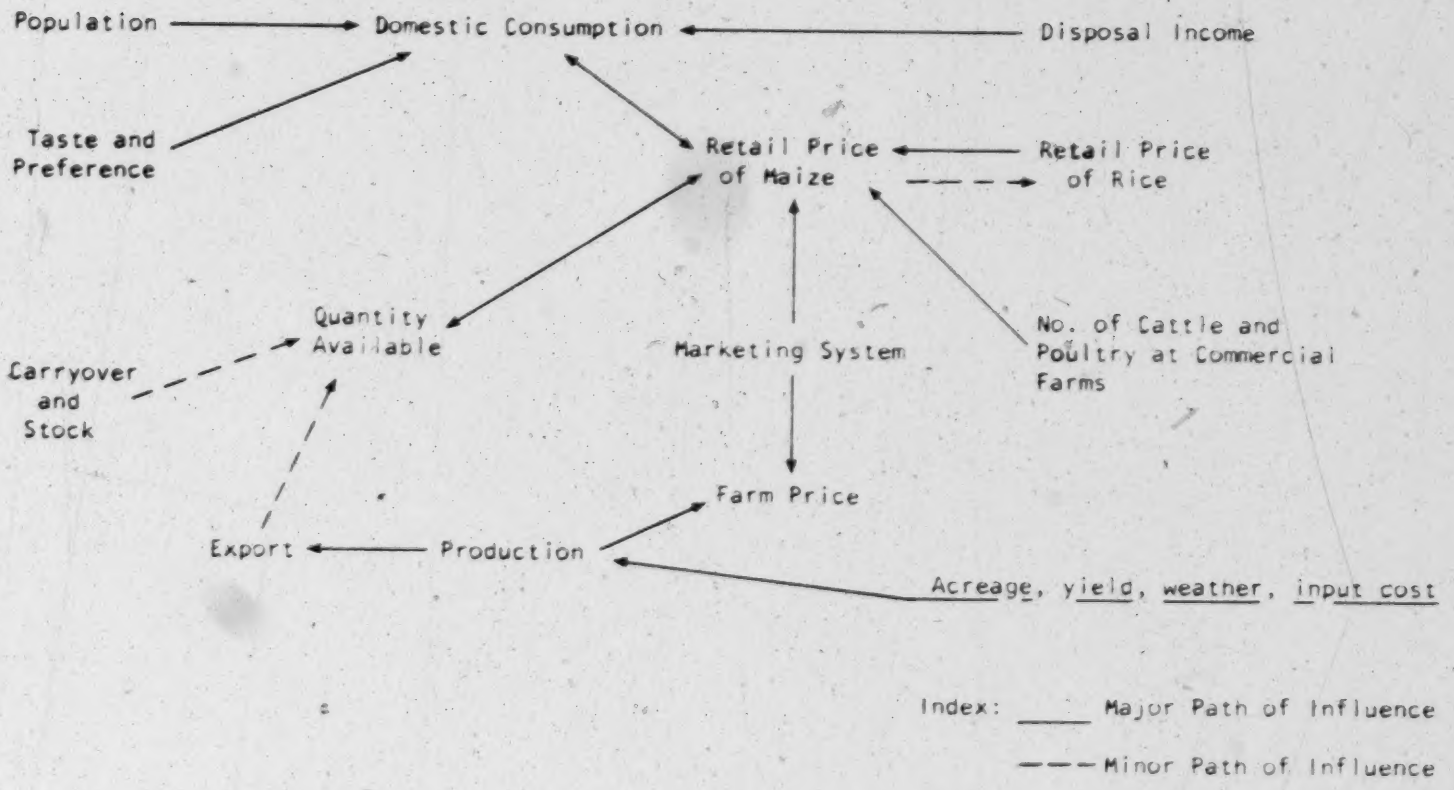


FIGURE 5.4

DEMAND, SUPPLY AND PRICE STRUCTURE FOR MAIZE, NEPAL



predictive purpose, and the structural equations might be used for the estimation of parameters.[1]

The use of ordinary least square (OLS) in a simultaneous system gives a biased and inconsistent result. Still, in a very small sample, there can be the advantage of small variance associated with the ordinary least squares.[2] In this study, there are only ten observations. Because of the small number of observations, the use of an equation system method would create the problem of inadequate degrees of freedom. This dictates the use of OLS.[3]

The price variable may approximate a linear relationship with the volume of quantity supplied, but the increase in income may have a nonlinear relationship with the price of food items like grain. A nonlinear relationship may exist between price and export demand. In this study, both the linear and the logarithmic form of equations are used.[4]

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[1] G. S. Shepherd, Agricultural Price Analysis (Iowa: Iowa State University Press, 1963), pp. 163-164.

[2] R. J. Wonnacott and T. H. Wonnacott, Econometrics (New York: John Wiley and Sons, Inc., 1970), pp. 399.

[3] On the basis of various studies, K. Fox and G. Shepherd concluded that the usefulness of the single equation multi-regression method cannot be minimized simply because of its neglect of simultaneity. Wonnacott and Wonnacott also conclude that "...even if limited resources dictate OLS, the results in small samples may still compare well with more complicated techniques." See: K. A. Fox, Econometric Analysis and Public Policy (Iowa: Iowa State University Press, 1958); G. S. Shepherd, Agricultural Price Analysis (Iowa: Iowa State University Press, 1963); and R. J. Wonnacott and T. H. Wonnacott, Econometrics (New York: John Wiley and Sons, Inc., 1970), p. 400.

[4] In many analysis carried out by the Agricultural Marketing Service, USDA, based on undeflated data, the logarithmic form of equation is found to be better than the linear equation. The choice of form of equation depends also upon the type of relationship, whether multiplicative or additive. R. J. Foote points out that the logarithmic equation is to be used when the relationship is multiplicative, the relationship is more stable in percentage than in absolute terms, and "the unexplained residuals are believed to be more uniform over the range of the independent variables when expressed in percentage rather than absolute terms." See: R. J. Foote, Analytical Tools for Studying Demand and Price Structures, Agricultural Handbook No. 146 (Washington, D.C.: USDA, August, 1958), p. 37.

As reported earlier, various models were prepared. The coefficients of the models were estimated by ordinary least squares. Tests of significance of the regression equations and the individual coefficients were based on the F-statistics and Student's t-statistics, respectively. The significance level of estimated equations was set at 0.05, and 0.05 and 0.10 were the significance levels for the estimated coefficients.

The two best explanatory relationships from the various estimated equations are selected for discussion of the prices of each commodity at the national and each regional level. The selections are based on the statistical criteria of the significance of the overall association amongst the variables (F-ratio).[1] The estimated equations with higher F-values may not necessarily have higher R^2. In some cases, the selected equations have slightly lower F-values, but the estimated coefficients of more variables are statistically significant than the other equations. The selection in such cases is done by also examining the significance of the estimated coefficients (T-ratios). The tests of autocorrelation for all the selected equations were either inconclusive or showed no problem of autocorrelation. The empirical results and economic analysis follow.

Empirical Results and Economic Analysis

Cereal Grain Prices, Nepal

The empirical results of the selected two equations (number 1, linear and 2, nonlinear model) indicated that the per capita income,

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[1] Discussion of these criteria may be found in any standard text on econometrics. For example, see: J. Johnston, Econometric Methods (New York: McGraw-Hill Book Company, 1963), pp. 106-142.

per capita availability of grains, rice price in India and population in Nepal were the important variables in affecting the price of cereal grains in Nepal (Appendix XIII). The linear estimation showed that the rice price in India was more important than the per capita income in terms of percentage variation explained. The logarithmic equation gave the reverse results. The logarithmic equation had slightly greater F-value and R^2. The signs of the estimated coefficients, except that of population variable, were as expected.

Based on the selected linear estimation, the income elasticity of the price of cereal grain was 1.98. The price flexibility to the change in the per capita availability of cereal was -1.13. Its responsiveness to the change in the wholesale price index of rice in India was 1.17. Compared to the calculated elasticities from the linear model, the estimated coefficients in the logarithmic form were low.

Rice Price, Nepal

The income, the price of rice in India and per capita availability were the important variables in affecting the price of rice in Nepal. The total production of maize and wheat in Nepal was not a significant variable. One linear equation (2) and one nonlinear equation (4) are selected for economic analysis (Appendix XIV).

All the estimated coefficients of variables in the linear equation were significant. But the coefficient of the per capita availability of rice was significantly not different from zero at the 90 percent level in the logarithmic form. The income elasticity of price of rice, as indicated by the estimated coefficient of the equation in the nonlinear form, was 1.38. The response of price of rice in Nepal to the change in the wholesale price of rice in India

was 0.92. When elasticities were calculated from the estimated coefficients in the linear equation, the price flexibility with respect to change in the per capita income was only 0.45. The responsiveness of price of rice to the change in the price of rice in India and per capita availability of rice in Nepal were 1.066 and -0.881, respectively. Thus, there was a substantial difference in the income elasticities of price calculated form the selected linear and nonlinear estimations. The responses of the prices of rice to the changes in the per capita availability of rice were greater than the responses of cereal grain prices to the changes in per capita availability of aggregate cereal grain in Nepal.

Wheat Flour Price, Nepal

In the analysis of price of wheat flour in Nepal, the price of flour in India and the volume of wheat production in Nepal were not the significant variables. Price of rice in Nepal, per capita income and population were significant variables in affecting prices of flour. In terms of percentage variation explained, the price of rice was the most important variable.

The selected estimation in the multiplicative form (equation number 4) indicated that the wheat price flexibility to the change in the price of rice in Nepal was 1.02, slightly less than the calculated price flexibility coefficient of 1.13 based on the selected linear equation number 2 (Appendix XV). In the logarithmic equation, the responsiveness of the wheat flour price to the change in the per capita income was 1.119. The income elasticity coefficient calculated from the linear equation was 1.232. Thus, the estimated wheat flour price elasticity in relation to the change in income did not differ much with the changes in the form of equation.

Maize Price in Nepal

None of the models attempted to estimate the relationship between the prices of maize. The explanatory variables showed a significant association among the variables. The F-values were not significantly different from zero. However, coefficients of the price of rice variable were significant at least at 90 percent level (Appendix XVI). This might have happened by chance. One of the causes of this problem might be the lack of regular maize price data for all the regions during the period under the study.

Rice Price, Eastern Tarai

The important variables affecting price of rice were rice production in the eastern Tarai, price of rice in India, per capita income in Nepal, and population in this region. The total production of maize and wheat was not a significant variable.

The selected linear estimation showed that the price of rice in India was the important variable and that it explained 77 percent of the variation in the price of rice in eastern Tarai. The nonlinear estimation, however, indicated that income was the most important variable explaining the highest percentage variation in price. R^2 of both the estimations was 98 percent. But the F-value of the nonlinear estimation was higher than that of the linear estimation.

Based on the linear estimation equation number 2, the calculated price flexibility to the change in price of rice in India was 1.313. The responsiveness of the price to the change in rice production in eastern Tarai was -1.554. The income elasticity of price was 2.186. The elasticity coefficients given by the nonlinear

estimation (equation 4) were lower than the coefficients calculated from the linear estimation (Appendix XVII).

The fluctuations in rice production in eastern Tarai and the rice price in India were greater than the per capita income in Nepal. As the responses of prices of rice in eastern Tarai to the changes in the former two variables were higher, the fluctuations in those variables could cause substantial instability in rice prices in the eastern Tarai. The results also indicated that the impact of change in the rice prices in India and in the per capita income in Nepal were greater on the price of rice in eastern Tarai than on the national average price of rice.

Wheat Flour Price, Eastern Tarai

The selected estimations (equations 3 and 6) showed that the price of rice in the eastern Tarai was the most important variable, which explained 87 percent variation in the price of wheat flour in the eastern Tarai (Appendix XVIII). The wheat price in India was not a significant variable. The income variable, which was significant in the relationship with the prices of rice in eastern Tarai, was not significant in its relationship with the prices of wheat flour. Wheat production variable was also significant at this regional level although production variable was not important at the national level.

Based on the selected linear estimation, the responsiveness of the price of wheat to the change in the price of rice in eastern Tarai was 0.869. The price flexibility coefficient to the change in wheat production was -0.239. The elasticity coefficients given by the nonlinear estimation were not significantly different from the calculated

elasticities based on the linear estimation. The greater variations in wheat flour price could occur because of the fluctuations in the prices of rice rather than because of the variation of prices caused by the fluctuations in wheat production. Stability in rice price is, therefore, more important than the stability of wheat output in reducing fluctuations of wheat flour price.

Rice Price, Western Tarai

The important variables affecting prices of rice in western Tarai were prices of rice in India, per capita income, rice production, and population in western Tarai. The signs of the estimated coefficients of these explanatory variables, except that of the population variable, were as expected. The best explanatory model is equation 3 in the linear form (Appendix XIX).

The selected linear estimation indicated that the income elasticity of price of rice in western Tarai was 1.91. The price flexibility to the changes in the price of rice in India and the rice production in this region were 1.33 and -0.38, respectively.

In contrast to the estimation of the price relationships in eastern Tarai, the responsiveness of the prices of rice to the changes in rice production in western Tarai were very low. As stated earlier, the responsiveness of the prices of rice to the change in the rice production in eastern Tarai was -1.544, but it was only -0.38 in the case of western Tarai. Therefore a 1 percent increase in rice production in eastern Tarai must have had a greater impact on lowering the price of rice in this region than the same percentage change in western Tarai. This also indicates that western Tarai requires a greater proportion of

rice as a stock than eastern Tarai requires in order to reduce the fluctuations of prices of rice by an equal percentage in these respective regions.

Wheat Flour Price, Western Tarai

The two selected estimations (equations 3 and 6) showed that the price of rice and production of whea. were significant variables affecting prices of wheat flour. As in eastern Tarai, per capita income and the price of wheat in India did not have statistically significant relationships with the prices of wheat flour in western Tarai (Appendix XX).

Based on the selected linear estimation (equation 3), the wheat flour price flexibility to the change in the price of rice in western Tarai was 0.44, which was less than the coefficient in eastern Tarai. On the other hand, the responsiveness of wheat flour price to the change in wheat production was -0.27, which was slightly higher than the coefficient in the eastern Tarai. Thus, the responsiveness of prices of wheat flour to the changes in the two variables above were different in the two regions of the Tarai.

The elasticity coefficients given by the nonlinear estimation were higher than the linear estimation. However, the response of wheat flour price to the change in the price of rice was substantially lower in the western Tarai than in the eastern Tarai. In terms of F-value and R^2, the logarithmic estimation was better than the linear estimation in both regions of the Tarai.

Rice Price, Kathmandu Valley

The two important variables affecting price of rice in the Kathmandu Valley were population and rice production in the Valley. The price of wheat flour and the total production of wheat and maize were not the significant variables. The estimated coefficient of the income variable was statistically not significant at 90 percent level.

The two selected equations, 3 and 6, are in the linear and nonlinear forms, respectively (Appendix XXI). The calculated rice price flexibility to the change in rice production was -0.792. The response of the price to the change in the population was 5.692, which was very high. These estimated elasticities from the linear equation were higher than the estimated coefficients in the logarithmic form.

Wheat Flour Price, Kathmandu Valley

In the Tarai and at the national level, the price of rice was an important variable, but this variable was not significant in affecting the price of flour in the Kathmandu Valley. The price of maize also was not a significant variable. The two important variables were per capita income and wheat production. The income variable was more important than the wheat production variable.

The income elasticity of price of flour was 1.888. The wheat flour price flexibility to the change in wheat production was -0.562, which was substantially higher than the elasticity coefficients in eastern and western Tarai. Calculated elasticities based on linear equation 2 were higher than the coefficients given by the logarithmic equation 4 (Appendix XXII).

Price of Rice, Eastern Hills

The variable price of rice in eastern Tarai was most important in affecting price of rice in Eastern Hills, and its partial coefficient of determination was 0.657. An interesting observation was that the rice production did not come up as a significant explanatory variable, but total maize and wheat production was a significant variable. The partial coefficient of the total maize and wheat production variable was 0.507.

Based on the selected linear estimation (equation 2), the flexibility of the price of rice in eastern Hills to the change in the price of rice in eastern Tarai was 0.58. The responsiveness of the rice price to the change in total production of maize and wheat and to population in the eastern Hills was -0.30 and 3.52, respectively (Appendix XXIII).

Wheat Flour Price, Eastern Hills

Production was a significant variable in affecting the wheat flour prices in eastern and western Tarai and the Kathmandu Valley, but that variable was not found significant in eastern Hills. The only significant estimated coefficient was that of the price of wheat flour in eastern Tarai. The prices of rice and wheat flour in eastern Hills were associated with the prices of rice and wheat flour in eastern Tarai.

The selected linear equation 3 indicated that the response of the price of wheat flour in eastern Hills to the change in the wheat flour price in eastern Tarai was 0.80. The logarithmic function (equation 6) showed that the wheat flour price flexibility to the change

in the price of rice and wheat production in eastern Hills was 0.236 and 0.025, respectively (Appendix XXIV).

Rice Price, Western Hills

Rice production was a significant variable in affecting price of rice in western Hills. As in eastern Hills, the total production of maize and wheat was a significant factor affecting the price of rice in western Hills. The other important variables were the price of rice in western Tarai and per capita income.

Based on the linear estimation (equation 3), the rice price flexibility coefficients to the change in the total production of maize and wheat, the price of rice in western Tarai, per capita income, and the rice production in western Hills were -1.51, 0.96, -0.24 and 0.43, respectively (Appendix XXV). However, the signs of the estimated elasticity coefficients of rice production and income variables were not as expected. The two other variables were more reliable. The responses of prices of rice to the changes in prices of rice in western Tarai and to the total maize and wheat production were greater in western Hills than in eastern Hills.

Wheat Flour Price, Western Hills

The results of the analysis of the factors affecting the price wheat flour in western Hills were different from the results obtained from the analysis in eastern Hills. In eastern Hills, the price of wheat flour in eastern Tarai was found as a significant variable, but the price of wheat flour in western Tarai was not a significant variable in affecting the price of flour in western Hills. The estimated coefficients of wheat production and the price of rice variables were significant in the western Hills, but were not significant in eastern Hills.

Based on the selected linear equation 1, the calculated elasticity coefficient of the price of wheat flour to the change in the price of rice in western Hills was 1.48 (Appendix XXVI). The responsiveness of the wheat flour price to the change in wheat production was 0.72. The sign of the estimated coefficient was not as expected. The elasticity coefficients with respect to the changes in the income and the price of wheat flour in western Tarai were 0.152 and 0.394, respectively. The wheat flour price response to the change in the price of rice was very high in this region.

The above analysis of retail prices of various cereal grains at the national and at the eastern Hills regional level indicated that the volume of wheat production was not statistically a significant variable affecting the prices of wheat flour. In other regions, this variable was important but the elasticity coefficients were very low. Also, the production of maize and wheat was not a significant variable affecting prices of rice at the national and the Tarai level. On the other hand, the total production of maize and wheat was statistically a significant variable affecting price of rice, particularly in the western Hills. However, the price of rice is an important variable affecting the price of wheat flour at the national and regional levels (except in the Kathmandu Valley and the eastern Hills).

Rice price analysis at the national and regional levels showed that the production of rice was a significant variable. The responsiveness of the prices to the changes in rice production were very high at the national level, and in the Kathmandu Valley and the eastern Tarai. The degree of price flexibility was low in the western Tarai.

The price of rice in the Tarai is an important factor affecting price of wheat flour in the Tarai and the prices of rice in the Hills. Therefore, a decline in the production of rice in the Tarai leads to a rise in its price, and also its effects are the rise in prices of other grains in the Tarai, and the prices of rice in the Hills.

The nature of the rice price relationship with the production of rice also indicates that the fluctuations of output in the Tarai could be an important factor responsible for instability in its prices in the Tarai and the Hills.. Supply regulation through measures such as the operation of buffer stock of grains, particularly rice, would help reduce fluctuations of grain prices caused by the fluctuations in annual production in the Tarai and the Hills.

As mentioned in Chapter II, the government used to procure grains in the Tarai and dispose of it in the Kathmandu Valley, and occasionally grains were used to meet a severe deficit in the Hills. The programme in the past, however, was not specifically designed for the stability of prices in the Tarai and/or the Hills. The size of procurement was substantially low. In the Fourth Plan, the government has envisaged programmes for the operation of buffer stocks of grains to reduce fluctuations of prices in the various regions.

The statistical analysis of prices showed that the regulation of rice supply in the Tarai and the regulation of maize and wheat supply in the Hills seemed an important measure to stabilize prices. In the next chapter, therefore, an analysis of the economics of buffer stock operation is carried out. As indicated by the price analysis, the

operation of a buffer stock for rice is more important. Therefore, attempts are made to estimate the sizes of buffer stocks of cereal grains, as well as rice separately, in order to stabilize price of grains in the different regions of Nepal.

CHAPTER VI

ECONOMICS OF OPERATION OF BUFFER STOCK AND ITS ESTIMATIONS

Introduction

In the previous chapter, the results of the statistical analysis of prices of grains indicated that production and price had an important relationship. Price fluctuates along with the variation in output. Therefore, stabilization of output helps reduce fluctuations in prices caused by fluctuations in output. One of the major conventional price policy objectives is to reduce wide fluctuation of prices. This objective is still widespread and essential.[1]

The welfare effects of price stabilization on consumers and producers depend upon the causes of price fluctuations. Consumers lose under a price stabilization programme if the price fluctuations are caused with a shift in supply to the right. When price is stabilized producers lose if the price fluctuations are casued with the shift in demand under the perfect competition. However, the price stabilization through buffer stock with zero cost of storage brings a net social gain whether price fluctuations have occurred because of the shifts in demand or in supply.[2]

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[1] F.A.O., An Inquiry into the Problems of Agricultural Price Stabilization and Support Policies (Rome: F.A.O., 1960), p. 155.

[2] F. V. Waugh, "Does the Consumer Benefit from Price Instability?" Quarterly Journal of Economics, Vol. LVIII (Aug., 1944), p. 614; Walter Oi, "The Desirability of Price Instability Under Perfect Competition," Econometrica, Vol. 29 (Jan., 1961), p. 64; and B. F. Massel, "Price Stabilization and Welfare," Quarterly Journal of Economies, Vol. LXXXIII (May, 1969), pp. 284-298.

The magnitude of gain or loss depends on the level of cost of storage and the degree of price instability. Gain from price stabilization is greater where price instability is greater. If the difference between the buffer stock agency's sale return and the purchase cost is greater than the cost of storage, there is a gain resulting from a stabilization programme such as the operation of buffer stock.

It is difficult to determine precisely the appropriate size of buffer stock. The size of buffer stock depends on various factors such as the financial allocation that government is willing and able to make, preexisting organizational structure, operational experience, price elasticity of demand, frequency and size of fluctuation in production, and extent of price fluctuations permitted in the open market by the stabilizing agency. Besides the aforementioned, the government purchase and sale of grains in a given year depends upon the level of production in that year, storage capacity, and other political and economic factors. In developing countries with buffer stock programmes, the size of stock ranged from 10 to 20 percent of the volume of marketed surplus in average years, with 14 to 15 percent as a common provisional target.[1]

The need for buffer stock for the stabilization of seasonal as well as annual prices in Nepal has been emphasised since the initiation of the planned process of economic development in 1956. However,

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[1] H. C. Creupelandt and J. C. Abbott, "Stabilization of Internal Markets for Basic Grains: Implementation Experience in Developing Countries," Monthly Bulletin of Agricultural Economics and Statistics, Vol. 18, No. 2 (1969), p. 4.

no steps were taken except for the purchase and sale of limited amounts of grain to occasionally meet deficits in some areas and to increase supply of rice during the off-season in the Kathmandu Valley. An attempt is made in this chapter to analyse the economics of the operation of buffer stock and to estimate its potential sizes for the stabilization of annual regional cereal grain prices in Nepal.

Economics of Operation of Buffer Stock

A simple analysis of the operation of a buffer stock programme follows. In Figure 6.1, Q_t is the estimated trend of production. The possible fluctuations of production above and below Q_t before the initiation of the programme are indicated by Q_u and Q_L, respectively. The agency responsible for the programme has to moderate the fluctuations from Q_u and Q_L to Q_2 Q_1.

The buffer stock agency does not have to acquire or dispose of grain in the market if the production is between the range of Q_1 and Q_2. If the production is Q_u or Q_L, the agency has to buy the difference between Q_u and Q_2 or sell the difference between Q_1 and Q_L. The narrower the range of Q_1 and Q_2, the higher the possibility of supply fluctuations above and below the permitted levels. Then there will be more possibilities of a regular operation of acquisition and disposal. On the other hand, the wider the range of Q_1 and Q_2, the lower the volume of stock required, and vice versa.

It is assumed that quantity produced is $0Q_1$ and that the open market price is P_1 in the first period (Figure 6.2). The agency has to procure the amount Q_1 Q_2 in order to raise the level of price from $0P_1$ to $0P_2$. On the other hand, when the quantity supplied is only

OQ_4, the release of stock to the extent of Q_4Q_3 brings down the price from OP_4 to OP_3. This is the case with constant demand and changing supply.

Demand and supply may change. However, supply fluctuations may be more frequent and greater in size than fluctuations in demand for cereal grains. When both demand and supply change, the change in price and quantity supplied and demanded may be different than what has been stated with reference to change in supply and constant demand in the preceeding paragraph.

In Figure 6.3, with changes both in supply and demand, the price is P_1 at the initial period when the demand is as indicated by the demand curve D and quantity supplied is OQ. In this situation, the agency has to procure the amount QQ_4 if it has the objective of raising the price to P_3. In the second period, if demand shifts to D_1 and supply shifts from S to S_1, the price may go up to OP_2. The agency has to sell Q_1 Q_2 to bring the price down to OP_3. If the market supply is S_2 instead of S_1, it has neither to acquire nor to dispose in order to achieve the price level OP_3.

Assumptions and Assertions for Estimation of Stock

The model used to estimate the size of buffer stock for the different regions of Nepal is based on the following assumptions and assertions:

1. It is evident from past experience that regional production of grains varies with the unpredictable nature of the weather. Even in the irrigated areas fluctuations of output are experienced whenever frequent drought and floods occur. Therefore it is assumed

FIGURE 6.1

TREND AND FLUCTUATIONS OF GRAIN PRODUCTION

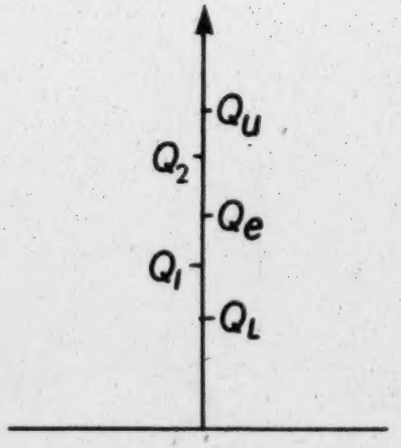


FIGURE 6.2

CHANGE IN PRICE WITH CHANGES IN SUPPLY AND CONSTANT DEMAND

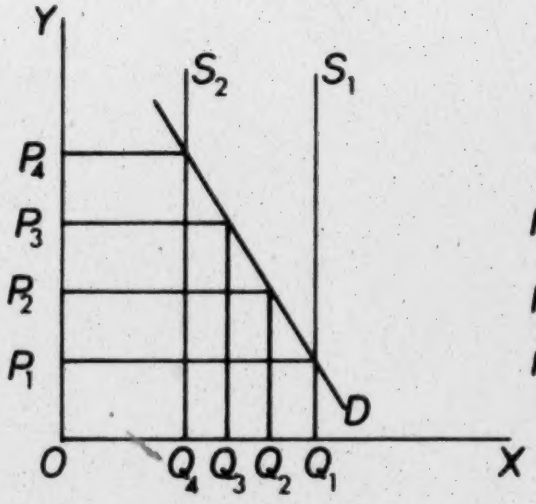
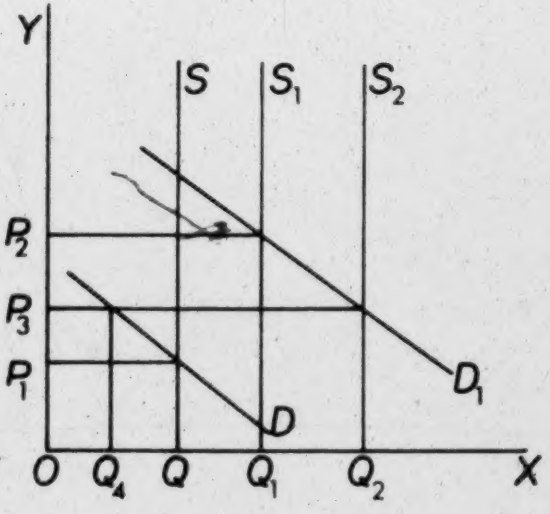


FIGURE 6.3

CHANGE IN PRICE WITH CHANGES IN SUPPLY AND DEMAND



that fluctuations of cereal grain output will continue from year to year because of changes in weather and in insect and pest damage.

2. Food grain export to India is free at present. If the volume of export increases when the output of grain declines in Nepal, the price may increase. Therefore, the disposal of stock by the price stabilizing agency in Nepal should be of a greater amount than the volume permitted by the decline in output. Whenever there is no effective regulation of export, it becomes more difficult to predict the volume of export in a given year, which may lead to less chance of success for a domestic price stabilization programme. It is assumed that there is an effective government control over the volume of export and import of cereal grains.

3. The Tarai grain market of Nepal is closely related to the markets in India. Whenever the foreign exchange rate changes, the prices not only of imported goods but also of cereal grains in Tarai are immediately affected. These, in turn, affect the level of prices in the Hills. Hence, it is assumed that there is a stable foreign exchange rate.

4. The stabilization of price brings certainty which reduces the risk of investment. The certainty in prices and the reduction in risk of investment provide incentive to use new technologies such as new improved seeds and chemical fertilizers. The stabilization of prices helps to reduce the fluctuations of real income of the consumers as well.

5. The variation in the interregional movement of grains occurs because of the varying degrees of regional price fluctuations. If the volume of interregional grain movements change substantially this may create greater instability in a particular region from where

the outflow of grains is increased. It is assumed that the inter-regional flow of grains will be in keeping with the operation of buffer stock.

6. In the 1960's, the extent of fluctuations of quantity of cereal grains demanded were less than the fluctuations of the quantity available for domestic use in Nepal. The trend of quantity demanded was increasing. Because of the continuous growth of population and increase in per capita income, the quantity of grains demanded will continue to increase. It is assumed that there will be a steadily increasing trend in demand for cereal grains and a rising price trend.

7. Last but not the least, it is important that the agency responsible for the operation of the buffer stock programme have foreknowledge of shifts in demand and supply schedules, and the trend of annual price around which it wants to stabilize prices. If the agency cannot correctly forcast demand or supply changes, it may be possible that the buying or the selling operation may make prices unstable. For instance, the agency becomes aware of the shift in supply from S to S_1, but is not aware of the shift of demand from D to D_1 (see Figure 6.3). It then carries out a buying programme to procure Q_4 Q_1 quantity of grains in order to drive the price up to OP_3. A possible effect of the operation is that the price level may be pushed up beyond level OP_2 because the agency is unaware of the shift in demand from D to D_1. With correct foreknowledge of shifts in demand and supply schedules, the agency would have carried out a selling programme amounting to Q_1 Q_2, in order to drive the price down to OP_3.

Procedures of Estimation

Size of buffer stock (B) equals the difference between the permitted level of output fluctuations (Q_1) below the trend (Q_t) and the lower end of possible output (Q_L) from the trend Q_t (Figure 6.1). In order to estimate size of buffer stock, Q_t is estimated and Q_u, Q_L, Q_1 and Q_2 are calculated.[1]

$$B = Q_1 - Q_L \tag{1}$$

$$\text{Log } Q_t = B_o + B_1 \text{ (Time)} + u \tag{2}$$

$$Q_1 = Q_t - P_e (P_p) (Q_t) \tag{3}$$

$$Q_2 = Q_t + P_e (P_p) (Q_t) \tag{4}$$

$$Q_u = Q_t + S_e \tag{5}$$

$$Q_L = Q_t - S_e \tag{6}$$

where:

Q_t is semilog production trend,

Q_1 and Q_2 are permitted levels of lower and upper limits of output fluctuations,

P_e is price elasticity of demand,

P_p is permitted annual price fluctuations in percentage around the trend,

Q_u and Q_L are the upper and lower limits of estimated fluctuations of production from the trend, and

S_e is the standard error of estimate.

Therefore, by substituting Q_1 and Q_L, buffer stock can be estimated with the following equation:

---

[1] Such a model has been used to estimate the size of buffer stock for India. See: S. Nanda and J. P. Houck, Buffer Stock of Food Grains: the Economics of Their Operation and Potential Size, Research Bulletin No. (Minnesota: University of Minnesota, Dept. of Agricultural and Applied Economics, 1971).

$$B = Q_t - P_e (P_p) (Q_t) - (Q_t - S_e) \quad (7)$$

The estimated requirement of storage capacity is given by the following equation:

$$S = Q_u - Q_2 \quad (8)$$

The steps of estimation are as follows:

1. Estimation of semilog trend of cereal grains output (Q_t).

2. Calculations of Q_u and Q_L with 1 and 1.96 standard deviations $\pm Q_t$.

3. Estimations of Q_1 and Q_2 of cereal grains are carried out under various permitted levels of annual price fluctuations, such as 0, $\pm$ 2.5, $\pm$ 5.0 and $\pm$ 7.5 percent in the open market with price elasticity of demand ranging from -0.6, -0.75 and -1.00.

The higher the price elasticity of demand, the smaller the size of buffer stock required in order to cope with price fluctuations around the trend. The required size of stock becomes greater when the possibilities of variations of output around the trend are high. Also the size of estimated stock becomes large if the permitted level of price fluctuations around the trend is low.

Estimations of Buffer Stocks of Cereal Grains at the National Level

The estimated annual average rate of growth of cereal grains was 1.79 percent during the past ten years. The estimated rate of growth of rice was only 1.25 percent. The projected trend of cereal grain based on semilog estimation is higher than the average for the period 1961/62 to 1970/71 (Table 6.1). In the context of increasing *technological as well as institutional reforms* for higher production of grains, the overall trend may be higher than the average. It is

TABLE 6.1

ACTUAL AND ESTIMATED TREND OF CEREAL GRAIN OUTPUT, NEPAL

Year	Actual	Estimated Trend	Deviation from Trend
		('000 Metric Tons)	
1961/62	2,317	2,278	+ 39
1962/63	2,323	2,318	+ 5
1963/64	2,331	2,359	- 28
1964/65	2,391	2,403	- 12
1965/66	2,475	2,442	+ 33
1966/67	2,335	2,485	-150
1967/68	2,533	2,529	+ 4
1968/69	2,660	2,571	+ 89
1969/70	2,753	2,619	+134
1970/71	2,564	2,665	-101

assumed that the trend will continue. A similar variation around the trend, as experienced in the past ten years, is assumed to hold true, even in 1974/75.

Once Q_t is estimated, Q_u, Q_L, Q_1 and Q_2 are calculated to estimate sizes of buffer stocks. The sizes of stocks are estimated with different price elasticities of demand, different permitted levels of price fluctuations and at different levels of assurance.

The estimated size of stock of cereal grain is 54,100 metric tons at the 67 percent level of assurance if price elasticity of demand is -0.6 and the permitted level of price fluctuation is ± 2.5 percent. The estimated capacity of storage required is 57,100 metric tons. There will be no need for buffer stock in 1974/75 if the price elasticity of demand for cereal grains is -0.6, if the permitted level of price fluctuations is ± 7.5 percent around the trend, and if the level of assurance is 67 percent (Table 6.2).

The size of stock has to be increased in order to increase the level of assurance. For instance, when the level of assurance is increased to 95 percent, the stabilizing agency has to build up stock to the amount of 149,100 metric tons with a permitted level of price fluctuations of ± 2.5 percent and a price elasticity of demand of -0.6. With the increase in the permitted range of price fluctuations, the size of stock becomes lower than 149,100 metric tons. If the permitted level is ± 5.0 percent or ± 7.5 percent, the required size of stock is 106,200 metric tons or 63,300 metric tons, respectively (Table 6.3).

Therefore, the suggested size of 50,000 metric tons of cereal grains is close to the estimated amount with a price elasticity of demand of -0.6, a permitted level of price fluctuations of ± 2.5 percent,

TABLE 6.2

ESTIMATED SIZES OF BUFFER STOCK OF CEREAL GRAIN FOR 1974/75, NEPAL[1]

(67 Percent Level of Assurance)

P_e	P_p	Q_t	Q_u	Q_L	Q_1	Q_2	B	S
	(%)				('000 Metric Tons)			
- 0.6	0	2,861	2,961	2,764	--	--	97.0	100.0
	±2.5	2,861	2,961	2,764	2,818.1	2,903.9	54.1	57.1
	±5.0	2,861	2,961	2,764	2,775.2	2,946.8	11.2	14.2
	±7.5	2,861	2,961	2,764	2,732.3	2,989.8	- 31.7	- 28.8
- 0.75	±2.5	2,861	2,961	2,764	2,807.4	2,914.6	43.4	46.4
	±5.0	2,861	2,961	2,764	2,753.7	2,968.3	- 10.3	- 7.3
	±7.5	2,861	2,961	2,764	2,700.1	3,021.9	- 63.9	- 63.9
- 1.0	±2.5	2,861	2,961	2,764	2,789.5	2,932.5	25.5	28.5
	±5.0	2,861	2,961	2,764	2,718.0	3,004.1	- 46.0	- 43.1
	±7.5	2,861	2,961	2,764	2,646.4	3,075.6	-117.6	-114.6

[1] P_e = Price elasticity of demand; P_p = permitted level of price fluctuations; Q_t is production trend; Q_u and Q_L are the upper and lower limits of fluctuations of production from the trend; Q_1 and Q_2 = permitted levels of lower and upper limit of output fluctuations from the trend; B = the size of buffer stock; and S = the storage capacity required.

TABLE 6.3

ESTIMATED SIZES OF BUFFER STOCK OF CEREAL GRAIN FOR 1974/75, NEPAL[1]

(95 Percent Level of Assurance)

P_e	P_p	Q_t	Q_u	Q_L	Q_1	Q_2	B	S
	(%)				('000 Metric Tons)			
-0.6	0	2,861	3,065	2,669	--	--	192.0	204.0
	±2.5	2,861	3,065	2,669	2,818.1	2,903.9	149.1	161.1
	±5.0	2,861	3,065	2,669	2,775.2	2,946.8	106.2	118.2
	±7.5	2,861	3,065	2,669	2,732.3	2,989.8	63.3	75.2
-0.75	±2.5	2,861	3,065	2,669	2,807.4	2,914.6	138.4	150.4
	±5.0	2,861	3,065	2,669	2,753.7	2,968.3	84.7	96.7
	±7.5	2,861	3,065	2,669	2,700.1	3,021.9	31.1	43.1
-1.00	±2.5	2,861	3,065	2,669	2,789.5	2,932.5	120.5	132.5
	±5.0	2,861	3,065	2,669	2,718.0	3,004.1	49.0	69.9
	±7.5	2,861	3,065	2,669	2,646.4	3,075.6	-22.6	-10.6

[redacted] P_e = Price elasticity of demand; P_p = permitted level of price fluctuations; Q_t = production trend; Q_u and Q_L = the upper and lower limits of fluctuations of production from the trend; Q_1 and Q_2 = permitted levels of lower and upper limit of output fluctuations around the trend; B = the size of buffer stock; and S = the storage capacity required.

and at a 67 percent level of assurance. The range of ± 2.5 percent price fluctuations around the trend is narrow, which is undoubtedly better. However, because of the low level of assurance, there is greater uncertainty in achieving the policy goal of stabilizing prices. At a greater level of assurance (for example, 95 percent level of assurance), the suggested size permits prices to fluctuate approximately ± 8.0 percent around the trend. The higher range of price fluctuations also involves uncertainty although the possibility of success of the programme within the permitted range is high.

Estimations of Buffer Stock of Rice at the National Level

In the previous chapters, especially Chapter V, it was indicated that rice was the most important crop in the economy of Nepal, and its price was a significant variable governing prices of other grains at the national level. If prices of rice can be stabilized, it would help reduce the fluctuations of prices of other grains. Therefore, an alternative is to build a stock of rice only.

The sizes of buffer stocks of rice are estimated at 67 and 95 percent levels of assurance with different ranges of permitted level of price fluctuations (0, ±2.5, ±5.0 and ±7.5 percent). With ±2.5 percent permitted level of price fluctuations, the estimated sizes are 39,600 metric tons at 67 percent level of assurance and 96,600 metric tons at 95 percent level of assurance. When the range of permitted price fluctuations is ±5.0, the estimated sizes are 21,000 metric tons and 78,200 metric tons at the 67 and 95 percent levels of assurance (Tables 6.4 and 6.5). The size of stocks may be estimated with 75 and 85 percent levels of assurance. The 95 percent level of assurance may

TABLE 6.4

ESTIMATED SIZES OF BUFFER STOCK OF RICE FOR 1974/75, NEPAL[1]

(67 Percent Level of Assurance)

P_e	P_p	Q_t	Q_u	Q_L	Q_1	Q_2	B	S
	(%)				('000 Metric Tons)			
-0.5	0	1,473	1,534	1,415	--	--	58.0	61.0
	±2.5	1,473	1,534	1,415	1,454.6	1,491.4	39.6	42.6
	±5.0	1,473	1,534	1,415	1,436.2	1,509.8	21.2	24.2
	±7.5	1,473	1,534	1,415	1,417.8	1,528.2	2.8	5.8
-0.75	±2.5	1,473	1,534	1,415	1,445.4	1,500.6	30.4	33.4
	±5.0	1,473	1,534	1,415	1,417.8	1,528.2	2.8	5.8
	±7.5	1,473	1,534	1,415	1,390.1	1,555.9	-24.9	-21.9
-1.00	±2.5	1,473	1,534	1,415	1,436.2	1,509.8	21.2	24.2
	±5.0	1,473	1,534	1,415	1,399.4	1,546.7	-15.6	-12.7
	±7.5	1,473	1,534	1,415	1,362.5	1,583.5	-52.5	-49.5

[1] P_e = Price elasticity of demand; P_p = permitted level of price fluctuations; Q_t = production; Q_u and Q_L = the upper and lower limits of fluctuations of production around the trend; Q_1 and Q_2 = permitted levels of lower and upper limits of output fluctuations around the trend; B = the size of buffer stock; and S = the storage capacity required.

TABLE 6.5

ESTIMATED SIZES OF BUFFER STOCK OF RICE FOR 1974/75, NEPAL[1]

(95 Percent Level of Assurance)

P_e	P_p	Q_t	Q_u	Q_L	Q_1	Q_2	B	S
	(%)				('000 Metric Tons)			
-0.5	0	1,473	1,597	1,358	--	--	115.0	124.0
	±2.5	1,473	1,597	1,358	1,454.6	1,491.4	96.6	105.6
	±5.0	1,473	1,597	1,358	1,436.2	1,509.8	78.2	87.2
	±7.5	1,473	1,597	1,358	1,417.8	1,528.2	59.8	68.8
-0.75	±2.5	1,473	1,597	1,358	1,445.4	1,500.6	87.4	96.4
	±5.0	1,473	1,597	1,358	1,417.8	1,528.2	59.8	68.8
	±7.5	1,473	1,597	1,358	1,390.1	1,555.9	32.1	41.1
-1.00	±2.5	1,473	1,597	1,358	1,436.2	1,509.8	78.2	87.2
	±5.0	1,473	1,597	1,358	1,399.4	1,546.7	41.4	50.3
	±7.5	1,473	1,597	1,358	1,362.5	1,583.5	4.5	13.5

[1] P_e = Price elasticity of demand; P_p = permitted level of price fluctuations; Q_t = production trend; Q_u and Q_L = the upper and lower limits of fluctuations of production around the trend; Q_1 and Q_2 = permitted levels of lower and upper limit of output fluctuation around the trend; B = the size of buffer stock; and S = the storage capacity required.

be ideal, and 67 percent level of assurance may be low. Seventy-five percent, 85 percent and other levels of assurance between 67 and 95 percent may be appropriate.

Estimations of Buffer Stocks of Rice at the Regional Level

Grain markets in Nepal are regionalized. Output trend varies in different regions. The movements and behaviour of prices are not similar in all regions. A direct estimation of a national stock from the trend of national output and the possible variations of output from the trend not only creates the problem of allocation of stock to different regions, but also the national estimation may not be adequate to meet regional requirements based on the regional price and output situations.

Intuitively, it may be reasonable to allocate a greater volume of stock for the eastern Tarai because this region has the highest percentage of the national output of grains in Nepal. However, the western Tarai may need larger stocks of grains than the eastern Tarai if possibilities of larger output fluctuations exist in the western Tarai. The aggregate national size of stocks of rice may be more reliable if these are calculated from the sizes of stocks required for all regions based on regional conditions. Therefore, an attempt is made to estimate sizes of buffer stocks of rice for each region.

Regional estimations of buffer stocks of rice are carried out on the basis of respective regional rice production trends and the possible variations of output around the trends. The increasing trends of prices and demand are assumed. The price elasticity of demand for rice can vary in the different regions. Due to lack of data for each region, a price elasticity of demand of -0.5 is assumed for all the regions.

Estimations are made with ±2.5 percent and ±5.0 percent market price fluctuations around the trend, and at different levels of assurance, such as 67 percent, 75 percent, 85 percent and 95 percent. The estimations at different levels of assurance allow numerous alternative choices. As already stated in Chapter III, the rice price instability coefficients were about 10 percent. Prior to the initiation of a price stabilizing programme, a price instability of about 10 percent around the trend is expected. Therefore, the estimations of stocks with ±10 percent permitted level of price fluctuations are not carried out.

The regional estimations show that the required stock of rice is greater for the western Tarai than for the eastern Tarai because the fluctuations of output and pricesof rice were higher in the former region. The requirement of stock is greater for the Valley than for the eastern Hills (Tables 6.7 and 6.8).

When based on the separate regional estimations the total national sizes of stocks of rice are greater than the estimations made directly from the national output trend and the possibilities of variations of output around the trend. For instance, the estimated sizes of stocks of rice at 95 percent level of assurance and with ±5.0

TABLE 6.6

ESTIMATED SIZES OF BUFFER STOCKS OF RICE AND REQUIRED STORAGE CAPACITY BASED ON REGIONAL ESTIMATIONS, NEPAL

(Price Elasticity of Demand = -0.5)

Permitted Price Fluctuations	Buffer Stocks	Storage Capacity
	('000 Metric Tons)	
	67 Percent Level of Assurance	
±2.5	56.7	62.5
±5.0	41.1	47.7
	75 Percent Level of Assurance	
±2.5	67.1	74.7
±5.0	51.5	59.2
	85 Percent Level of Assurance	
±2.5	87.0	98.7
±5.0	71.4	83.2
	95 Percent Level of Assurance	
±2.5	123.9	146.9
±5.0	108.4	131.4

TABLE 6.7

ESTIMATED SIZES OF BUFFER STOCKS OF RICE AND REQUIRED STORAGE CAPACITY WITH P_e -0.5 AND P_p ±5.0 PERCENT FOR DIFFERENT REGIONS, NEPAL[1]

Regions	67 Percent Level of Assurance		75 Percent Level of Assurance		85 Percent Level of Assurance		95 Percent Level of Assurance	
	Buffer Stock	Storage Capacity	Buffer Stock	Storage Capacity	Buffer Stock	Storage Capacity	Buffer Stock	Storage Capacity
	('000 Metric Tons)							
E. Tarai	8.6	9.6	12.7	14.1	20.6	22.8	35.6	39.9
W. Tarai	25.1	28.9	29.9	34.8	38.9	46.5	55.4	70.3
Kathmandu Valley	4.3	4.9	5.2	6.0	6.9	8.0	10.0	12.2
E. Hills	3.1	4.3	3.7	4.3	5.0	5.9	7.4	9.0
Total[2]	41.1	47.7	51.5	59.2	71.4	83.2	108.4	131.4

[1] P_e is price elasticity of demand, and P_p is permitted level of price fluctuations.

[2] The total does not include stocks for the western Hills.

TABLE 6.8

ESTIMATED SIZES OF BUFFER STOCKS OF RICE AND REQUIRED STORAGE CAPACITY WITH P_e -0.5 AND P_p ±2.5 PERCENT FOR DIFFERENT REGIONS, NEPAL[1]

Regions	67 Percent Level of Assurance		75 Percent Level of Assurance		85 Percent Level of Assurance		95 Percent Level of Assurance	
	Buffer Stock	Storage Capacity	Buffer Stock	Storage Capacity	Buffer Stock	Storage Capacity	Buffer Stock	Storage Capacity
	('000 Metric Tons)							
E. Tarai	18.3	19.3	22.4	23.8	30.3	32.5	45.3	49.6
W. Tarai	29.3	33.1	34.1	39.0	43.1	50.7	59.6	74.5
Kathmandu Valley	5.2	5.8	6.1	6.9	7.8	8.9	10.9	13.1
E. Hills	3.9	4.3	4.5	5.0	5.8	6.6	8.1	9.7
Total[2]	56.7	62.5	67.1	74.7	87.0	98.7	123.9	146.9

[1] P_e is price elasticity of demand, and P_p is permitted level of price fluctuations.

[2] The total does not include stocks for the western Hills.

percent permitted level of price fluctuations are 108,400 metric tons and 78,200 metric tons based on regional estimations and direct national estimation. Based on the regional estimations, the required sizes of stocks of rice with ±5.0 percent permitted level of price fluctuations are 41,100 metric tons at 67 percent level of assurance, 51,500 metric tons at 75 percent level of assurance, 71,400 metric tons at 85 percent level of assurance, and 108,400 metric tons at 95 percent level of assurance (Table 6.6).

An important issue is the level of assurance; the 67 percent level of assurance indicates that the stabilizing agency may be able to cope with price instability caused by the fluctuation in annual output in two out of three years on average. There is still great uncertainty because of the low level of assurance. The assurance level of 67 percent can be questioned in terms of an acceptable policy goal given the size and cost of facilities and the administrative effort necessary to undertake the policy. Higher certainty is essential.

With the increases of the levels of assurance to 75 percent, 85 percent and 95 percent, the certainty of price stability increases successively. At 75 percent level, a price instability problem can be solved in 15 out of 20 years on average, and at 95 percent level, the problem can be coped with in 19 out of 20 years. The objective of reducing the price instability to ±2.5 percent in the open market at 95 percent level of assurance is, in fact, an ideal one. At this level, the size of stock of rice required is 124,000 metric tons, but it is a highly ambitious policy goal in the context of existing organization and working capital.

Even with ±5.0 percent permitted level of price fluctuation, the sizes of stocks required at different levels of assurance are substantially high (Table 6.6). The operation of a buffer stock programme is very expensive in terms of the finance involved in maintaining stock of grains. For instance, to build an initial stock of 56,700 metric tons of rice, and to construct a storage capacity of 62,000 metric tons, the financial requirement is approximately Rs 339 million,[1] more than 50 percent of the total planned public sector outlay for agriculture during the Fourth Plan.[2]

There are other essential agricultural development programmes such as transportation development, storage improvements, irrigation development, improvement in quality of grains and development of high yielding varieties in Nepal.[3] The high cost of transportation is the important factor accounting for the higher level of prices of grains in the Hills than in the Tarai. The development of transportation is an essential condition for the overall growth of an economy. With better transportation facilities between the Tarai and the Hills, the

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[1] The financial estimation is based on the annual average wholesale price of paddy--Rs 1,450 per metric ton in 1971/72; and the storage construction cost--Rs 324 per metric ton. Price of rice is derived from price of paddy at the ratio of 1:1.66. But in the markets the price of rice is generally higher than the price given by the ratio. Hence, the estimation gives only a rough indication. See: Ministry of Agriculture, Progress Report: 1971/72 (Kathmandu: Ministry of Agriculture, 1972), p. 107.

[2] Ministry of Food and Agriculture, Agricultural Statistics of Nepal (Nepal: Ministry of Agriculture, 1972), p. 3.

[3] National Planning Commission, Fourth Plan (1970/71 to 1974/75) (Nepal: National Planning Commission, 1971).

regional price differences can be reduced, and the potential of price rise caused by a drop in production in a region can be minimized by transferring grains from a surplus to a deficit region.

Development of an improved storage system can help reduce seasonal as well as annual price variations. In Nepal, the farm and rice mills still use traditional storage systems. The loss at storage varies from 10 to 30 percent.[1] With improvement of the existing storage system, the per unit storage cost can be reduced. The benefit of decline in storage cost may be passed on in the form of lower prices to consumers, a higher return per unit of a product marketed by producers, and a higher profit to the intermediaries. Lack of rainfall on time and in adequate amounts is a major reason for fluctuations in output. The development of irrigation can help assure water for timely sowing and transplanting, and can help farmers to adopt new technologies such as improved seeds and chemical fertilizers.

The improvement in quality of grains is another important area in sustaining and extending export of grains to India and other foreign countries. At present, the quality of medium grade rice is equivalent to US rice number 5, the broken amounts ranging from 30 to 50 percent.[2] Because of the present rice quality, its export market is restricted to rice deficit markets in northern India. With the increase in income and grain production in India, Nepal may gradually lose her traditional markets.

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[1] D. R. Pfalser, "Storage, Drying and Transportation of Agricultural Commodities," MFA Agricultural Marketing Conference, Document No. 12 (Kathmandu: Ministry of Food and Agriculture, 1972).

[2] R. M. Grigsby, Expanding Export Markets for Nepali Rice (Kathmandu: USAID/Nepal, 1969). (Unpublished Report.)

Another important area is the development and extension of high yielding varieties which directly help to increase crop yields. In the Hills, grain production is not adequate. Increase in yield of cereal crops in this region is very important. The above development programmes should receive high priority in the agricultral development plans of Nepal.

The country did not experience a high degree of price and quantity instability for cereal grains in the 1960's when most underdeveloped countries were suffering from serious food grain price instability. The instability coefficients, as shown in Table 3.14, indicated that the price instability in Nepal had not been particularly high. All these suggest is that buffer stocks should be low on the list of policy priorities in the agricultural development of Nepal.

The model used to estimate the sizes of buffer stock shows that the buffer stock programmes may solve the problem of cereal grain price instability only if it is caused by fluctuations in domestic production. Grain prices in Nepal have an explicit relationship with the movements in rice prices in India; the prices in Nepal could move with the fluctuation in prices in India although grain production remains stable in Nepal. This indicates that the operation of buffer stocks to stabilize domestic prices of grains could be ineffective because of changes in important external factors such as instability of grain prices in the neighbouring states of India, changes in price support programmes and food policy in India. Therefore, a buffer stock programme for Nepal seems quite expensive in terms of huge finance to be invested, greater administrative efforts to be undertaken, and above all, the nature and

degree of explicit relationship between rice prices in India and Nepal. Some other alternatives must be considered in reducing instability of cereal grain prices in Nepal. In the next chapter, the summary, conclusions and policy implications are discussed.

CHAPTER VII

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

Summary

This study was concerned with the description of movements of retail prices of cereal grains, the analysis of factors affecting them, and the measurement of instability of regional prices of grains. The economics of the operation of buffer stocks were analysed. Estimations were made of the sizes of buffer stocks of rice necessary to reduce the instability of prices caused by fluctuations in output at the national and regional levels. The effectiveness of a buffer stock programme for Nepal was examined.

The country was divided into five major regions for the study: the western Hills, the eastern Hills, the Kathmandu Valley, the western Tarai, and the eastern Tarai. The prices of cereal grains, particularly of rice, were very high in the Hills where the per capita production of grains was lower than the per capita production in the Tarai. However, during the period 1961 to 1971, substantial percentage increases in prices were experienced in the Tarai. Significant increases in prices of all cereal grains in all regions were observed during the period 1962/63 to 1965/66.

The retail prices of rice and wheat flour were highly correlated in each region. The regional prices of rice were also positively correlated. The coefficients of variation of wheat flour prices were higher than the relative dispersions of prices of rice.

The highest coefficient of variation of prices of rice and the lowest coefficient of variation of prices of wheat flour were found in the western Tarai.

The fluctuations of the prices of rice around their trend were greater in the western Tarai than in the eastern Tarai. Of all the instability coefficients of rice prices, the lowest coefficient was in the Kathmandu Valley. However, the instability coefficient of price of wheat flour was very high in the Valley. The coefficients of instability of wheat flour prices were greater than the fluctuations of prices of rice.

Based on the economic theory of price, econometric models of the linear and nonlinear forms were prepared. The ordinary least squares technique was applied to estimate the relationships between prices and explanatory variables such as prices of rice in India and production of grains in Nepal.

The estimated relationships indicated that variables such as the wholesale price of rice in India and production of rice were important in affecting price of rice in Nepal. One of the important variables affecting prices of wheat flour and maize was the price of rice in Nepal. The wheat production variable was not statistically significant in affecting the price of flour at the national level. However, at the regional level, the wheat production variable was significant in all regions except in the eastern Hills.

The prices of rice in the Hills were significantly associated with the prices of rice in the Tarai. The price of rice in the Tarai was a significant variable affecting price of rice in the

Hills. On the other hand, the movement of prices of rice in India was the important factor governing movements of prices of rice in the Tarai.

The analysis indicates that prices of rice in the Tarai fluctuate with the fluctuations of rice production in this region as well as with fluctuations in prices of rice in India. Fluctuations of rice price in the Tarai can cause instability of price in the Hills.

In the Five Year Plans of Nepal, an important measure generally envisaged for the stabilization of prices is the operation of buffer stock. In this study, the economics of buffer stocks were analysed. The sizes of stocks of rice were estimated at different levels of assurance and with different permitted levels of price fluctuations around the trend. Since the instability of prices and the production of rice were greater in the western Tarai than in the eastern Tarai, the estimated sizes of stocks of rice were larger for the western Tarai than the eastern Tarai although the eastern Tarai produced two times more rice than the western Tarai.

Conclusions

Some of the important conclusions resulting from this study are as follows:

1. The responsiveness of prices of rice to changes in rice production vary from region to region in Nepal. The price flexibility to the change in rice production in the eastern Tarai was -1.555. It was only -0.38 in the western Tarai. Thus there were great variations in responsiveness of prices. The responses of prices of rice in the western Hills to changes in the prices of rice in western Tarai

were greater than the responses of prices of rice in the eastern Hills to the changes in prices of rice in eastern Tarai.

2. The estimated coefficients of the wheat production variable were not statistically significant in Nepal and in eastern Hills. In the regions, where the coefficients of the wheat production variable were significant, the responses of the prices of wheat flour to the changes in wheat production were lower than the responses of rice prices to the changes in rice production. Statistically, the variable prices of rice were important in affecting the prices of wheat flour.

3. There is an explicit relationship between the prices of rice in India, the Tarai and the Hills; the rice price movements in India influence the rice prices in the Tarai, and changes in prices in the Tarai bring changes in rice prices in the Hills.

4. The instabilities of prices of cereal grains around their trend were not very high in Nepal. The prices of wheat flour were more unstable than the prices of rice. The rice price variations in the western Tarai were greater than the price fluctuations in the eastern Tarai.

5. The operation of buffer stock helps stabilize annual prices of cereal grains in Nepal if that instability is caused by fluctuations in cereal grain output only. As already stated in the preceeding paragraphs, there is a significant relationship between prices of rice in India and Nepal. Hence, rice prices will be unstable in Nepal when unstable movements of prices of rice occur in India, even if rice production remains stable in Nepal. The buffer

stock programme will be ineffective in Nepal if India experiences a high instability of prices.

Policy Implications

In Nepal, instability of price and quantity of grains were not as high as experienced by most underdeveloped countries. A cereal grain price stabilization programme is not as important as the development of transportation, improvement of the storage system, development of high yielding varieties, development of irrigation and the improvement in quality of grains, as discussed briefly in Chapter VI. Therefore, the price stabilization programme should receive low priority in the agricultural development plan of Nepal.

A buffer stock programme is quite expensive for Nepal. Some other alternative measures for agricultural price support and stabilization are to be considered. Some of the important alternative measures are as follows.

Regulation of export plays an important role in supporting prices paid to producers or paid by consumers. The government can help promote additional export in cases of excess surplus available for export, and decrease the volume of export in order to make adequate supplies available for domestic use in times of low production. The regulation of export may be by financial methods, such as adjustment of export taxes and provisions of variable exchange rates. If these methods become ineffective, quantitative restriction or deficiency payments may be undertaken.

Another measure which does not involve price guarantee is the organization of marketing. Improvement in economic efficiency of

of marketing can help reduce retail prices without reducing farm prices. The government can encourage the operation of cooperatives and statutory marketing boards which strengthens the bargaining position of producers, and it may help undertake research, improve quality and promote markets. Such measures can raise the returns to the producers.

The government may also consider the possibility of a stabilization fund largely financed by the producers themselves during good years. These funds may be used to stabilize returns to the producers between years and seasons. Systems which are largely self-financing are more desirable in Nepal.

Measures other than price support of farm income are also to be given importance. Farm income can be raised through reductions of the cost of production. The government may extend duty free imports of chemical fertilizers, pesticides and machinery. Wherever desirable, provision for subsidies on these imported farm inputs may be made. Provisions also can be made for low interest credit rates to farmers. These measures have an immediate effect on cost of production. Technological measures such as development of high yielding varieties also helps reduce cost of production per unit of output in the long run.

In times of artificial shortage created by traders in certain domestic markets, the government can check and control their inventory and fix the wholesale and retail prices of products if necessary.

Lastly, an important improvement which deserves greater attention when undertaking any type of price support and stabilization

measure is the collection and dissemination of information. The most important information, namely prices, are collected by various organizations (such as the Nepal Rastra Bank, the Ministry of Food and Agriculture, and the Central Bureau of Statistics) in limited areas. The prices of very few commodities are collected at present. These are not published regularly. Also, the country has neither a consumer price index covering wider ranges of consumer goods nor data on quantities of grains marketed, available and demanded, essential items for the successful implementation of any price programme. At present, production and trade statistics for a given year are available only after one or two years. The coordination of activities of the organizations involved in collecting and disseminating data, particularly on price, is essential. A standard system and an efficient mechanism of price data collection are essential. It would be more economical and efficient if only one agency were mainly responsible for the collection of farm, wholesale and retail prices of agricultural commodities in Nepal.

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APPENDICES

APPENDIX I

TOTAL LAND CLASSIFIED BY ALTITUDES, NEPAL

Elevation in Meters	Area in Sq. Km.	Percentage of the Total
61 - 305	15,996.52	11.28
305 - 1,524	54,567.32	38.54
1,524 - 3,048	32,051.92	22.64
3,048 - 4,572	21,161.05	14.95
4,572 - 6,096	11,116.63	7.85
6,096 - 8,848	6,713.73	4.74
Total	141,577.17	100.00

SOURCE: K. B. Rajbhandari, Natural Environment and Crop Distribution in Nepal (Kathmandu: Ratna Pustak Bhandar, 1968).

APPENDIX II

LAND USE TYPE, NEPAL

Land Use Type	Area in Sq. Km.	Percentage of the Total
1. Agricultural	18,310	12.93
Hilly Region	6,000	4.24
Tarai Region	12,310	8.69
2. Forest Land	45,325	32.02
Hilly Region	28,819	20.36
Tarai Region	16,506	11.66
3. Other Land	77,942	55.05
Land Reclaimable	18,989	13.41
Land Unreclaimable	27,058	19.11
Land under Permanent Snow	21,121	14.92
Land Under River, Roadbed, etc.	10,774	7.61
4. Total of All Land	141,577	100.00

SOURCE: As in Appendix I.

APPENDIX III

CEREAL PRODUCTION IN NEPAL[1]

Fiscal Year	Production in Metric Tons	Percentage Change from Preceding Year Given in Table	Annual Rate of Increase for the Period in Percent
1956/57	3,097	--	--
1960/61	3,121	0.77	0.15
1961/62	3,151	0.96	0.96
1964/65	3,271	3.80	1.26
1969/70	3,717	13.63	2.72
1970/71	3,486	-6.22	-6.22

[1] Cereal grains include paddy, maize, wheat, barley, millet and other inferior cereal grains.

SOURCE: Ministry of Food and Agriculture, Annual Report (Kathmandu: Ministry of Food and Agriculture, 1969/70); Nepal Rastra Bank, Report of the Board of Directors to His Majesty's Government for the Fiscal Years 1961/62 to 1964/65 (Kathmandu: Nepal Rastra Bank, April, 1966).

APPENDIX IV

GRAINS EXPORTED FROM AND IMPORTED INTO NEPAL

Fiscal Year	Export			Import		
	Rice	Maize	Wheat[1]	Rice	Maize	Wheat[1]
	('000 Metric Tons)					
1962/63	88.0	13.0	0.2	--	--	5.0
1963/64	99.0	16.0	0.4	--	--	6.3
1964/65	122.0	12.0	0.6	0.3	0.1	2.5
1965/66	50.0	12.0	0.6	0.4	0.2	2.1
1966/67	122.0	12.0	0.2	1.2	0.1	2.4
1967/68	91.0	14.0	--	--	--	2.0
1968/69	102.0	10.0	--	--	--	2.0

[1] Includes wheat flour.

SOURCE: Central Bureau of Statistics, Trade Statistics, 1962/63 to 1968/69 (Kathmandu: CBS, 1962/63 - 1968/69).

APPENDIX V

SHARE OF EASTERN AND WESTERN TARAI IN TOTAL RICE AND PADDY EXPORT TO INDIA

Year/Region	1 E. Tarai	2 W. Tarai	3 Total	4 1+3 x 100
	(Metric Tons)			(Percent)
1967/68				
Rice	70,816	9,726	80,542	87.92
Paddy	3,183	14,215	17,398	18.29
1968/69				
Rice	71,670	20,798	92,468	77.50
Paddy	2,581	14,041	16,622	15.52

SOURCE: Ministry of Food and Agriculture, Annual Report, 1969/70 (Kathmandu: Ministry of Food and Agriculture, 1970), Appendix 1.

APPENDIX VI

ALLOCATION OF PLANNED PUBLIC SECTOR OUTLAYS IN THE FOUR PLANS BY MAJOR SECTORS, NEPAL

Sectors	Planned Outlay				Percent of the Total			
Total	330.0	600.0	1,740.0	2,570.0				
	Plan I	Plan II	Plan III	Plan IV	Plan I	Plan II	Plan III	Plan IV
	(Rs Million)							
1. Transport and Communication	111.5	143.5	615.0	1,026.7	33.8	24.0	35.4	40.0
a) Road, Railway and Ropeway	98.0	112.5	509.0	815.7	29.7	18.8	29.3	31.7
b) Aviation	6.0	25.0	70.0	171.0	1.8	4.2	4.0	6.7
c) Postal and Communication	7.5	6.0	36.0	40.0	2.3	1.0	2.1	1.6
2. Agriculture, Forest and Irrigation	116.0	117.1	377.5	703.9	35.2	19.5	21.6	27.4
a) Agriculture and Village Development	76.0	63.7	225.0	364.2	23.0	10.6	12.9	14.2
b) Forestry	20.0	13.4	52.5	80.8	6.1	2.2	3.0	3.1
c) Irrigation	20.0	40.0	100.0	258.9	6.1	6.7	5.7	10.1
3. Industry, Power and Commerce	55.0	193.0	385.0	446.0	16.7	32.2	24.2	17.4
a) Industry and Mining	24.0	90.0	105.0	183.0	7.3	15.0	6.0	7.1
b) Cottage Industry		10.0	15.0	22.7		1.7	2.5	0.9
c) Tourism and Trade	1.0	2.0	5.0	15.0	0.3	0.3	0.8	0.6
d) Electricity	30.0	91.0	260.0	225.3	9.1	15.2	14.9	8.8

Continued ...

APPENDIX VI (continued)

Sectors	Planned Outlay				Percent of the Total			
Total	330.0	600.0	1,740.0	2,570.0				
	Plan I	Plan II	Plan III	Plan IV	Plan I	Plan II	Plan III	Plan IV
	(Rs Million)							
4. Social Services	43.0	115.2	292.5	331.6	13.1	19.3	16.6	13.0
a) Education	19.0	40.0	130.0	119.8	5.8	6.7	7.5	4.7
b) Health	24.0	37.0	120.0	151.2	7.3	6.2	6.7	5.9
c) Drinking water		24.0	25.0	37.3		4.0	1.4	1.5
d) Sports		1.7	2.5			0.3	0.1	
e) Training		12.5	15.0	23.3		2.1	0.9	0.9
5. Miscellaneous	3.5	31.2	70.0	61.9	1.2	5.1	4.0	2.4
a) Statistics		23.0	9.0	14.7		3.8	0.5	0.6
b) Building			20.0	12.8			1.1	0.5
c) Broadcasting and Publicity		3.2	17.0	7.8		0.5	1.0	0.3
d) Public Administration		5.0	10.0	2.6		0.8	0.6	0.1
e) Hydrology and Meteorology			14.0	24.0			0.8	0.9

SOURCE: HMG/Nepal, Four Plans, Kathmandu: Nepalese Government.

APPENDIX VII

SOURCES AND NATURE OF DATA

National population statistics are available for the past 60 years (since 1911). Data on food grain prices are available for the past 50 years, but only for Kathmandu. Collection and estimation of other economic data such as national income and agricultural production have been carried on systematically since 1961/62.

At present, there are various sources for price data; namely, the Nepal Rastra Bank (NRB), Nepal Bank Ltd. (NB Ltd.), Rastriya Banijya Bank (RBB), Ministry of Food and Agriculture (MFA), and the Central Bureau of Statistics (CBS). Except for NB Ltd. price data, all the agencies are collecting most of their retail price data from the same markets. Farm price collection is nonexistent.

Price data are published by three organizations--the NRB, MFA and CBS. The only organization collecting data with adequate market coverage since 1961/62 is NRB. This bank has price data for Kathmandu since 1957. By 1961, 21 market centres in the Tarai, Kathmandu and the Hills were covered for price collection. Since 1971, the collection centres have increased to 26. The bank publishes consumer price indices of 15 individual commodities in its annual reports and quarterly economic bulletins.

Since 1962, CBS has published the weighted consumer price index for three markets of the Kathmandu Valley and has covered a wide range of food and non-food articles. MFA has more geographic areas and commodities covered. The data collected include only retail and

wholesale prices of agricultural and related commodities, and they are available only from the fiscal year 1964/65. The data are published in the annual reports. Since August, 1971, prices have been published in the monthly Agricultural Marketing Information Bulletin.

The data published by NRB are unweighted average price indices. The cereal grain price index is comprised of the price of rice and imported Indian wheat flour. The two other major cereal grains, maize and wheat, produced in the courtry are excluded.

Retail price data from NRB are used in this study. Monthly price data are supplied by the Research Department, Nepal Rastra Bank. The prices quoted are in various local volume and weight measurement units and are in various units for different years.

The sources of the price data for India and other data on production, national income, trade and population in Nepal are from the publications of the Reserve Bank of India, CBS, MFA, and NRB.

APPENDIX VIII

TOTAL VALUE OF MARKETED PRODUCTS, 1964-65, NEPAL

Item	Production (1,000 M.T.)	Import ('000 M.T.)	Quantity Marketed Percent of Domestic Production	Volume Marketed (1,000 M.T.)	Wholesale Price Per M.T.	Value of Domestic Marketed Product (Rs in Million)	Value of Import (Rs in Million)	Total Value (Rs in Million)	Weight in the Price Index
1. Paddy*	2,201.0	0.8	35	770.4	776.97	598.5	0.7	599.2	45.48
2. Pulses**	60.0	3.7	60	36.0	2,036.19	73.3	6.9	80.2	6.07
3. Potatoes	186.0	0.4	60	131.6	964.51	99.9	3.1	103.0	7.82
4. Ghee	8.5	0.1	70	6.0	11,000.00	66.0	0.4	66.4	5.01
5. Mustard Seeds***	51.0	5.8	70	35.7	1,982.61	70.8	10.0	80.8	6.15
6. Milk			5			43.9		43.9	3.34
7. Sugar	7.3	4.8	100	7.3	2,700.0	19.7	9.5	29.2	2.20
8. Pepper		2.0	n.a.			3.3	3.0	6.3	0.45
9. Wheat flour (india)		1.6					3.1	3.1	0.22
10. Salt		51.4					10.5	10.5	0.83
11. Cumin seed							2.2****	2.2	0.15
12. Kerosin oil		5.1 mil. gal.					6.5	6.8	1.36
13. Cotton Textile							275.4	275.4	20.88

* Rice calculated into Paddy.

** Include all pulses reported in the trade and statistics.

*** Mustard oil converted to seed at the rate--Seed 100:33 oil.

**** Half of value reported in Code No. 075298 of trade statistics.

SOURCE: Ministry of Food and Agriculture, Kathmandu, Nepal; Central Bureau of Statistics, Kathmandu, Nepal.

APPENDIX IX

WEIGHT CONVERSION

	Dharni	Seer	Mound	Pound	Kilogram
Dharni	1.000	2.265	0.064	5.276	2.393
Seer	0.390	1.000	0.025	2.058	0.933
Mound	15.595	40.000	1.000	82.287	37.324
Pound	0.190	0.486	0.012	1.000	0.454
Kilogram	0.418	1.071	0.027	2.205	1.000

VOLUME TO WEIGHT CONVERSION

Item	Kg. Equivalent of 1 Mana	Kg. Equivalent of 1 Pathi	Kg. Equivalent of 1 Muri
Rice	0.4546	3.6290	72.58
Paddy	0.3048	2.4384	48.77
Maize	0.4253	3.4024	68.05
Wheat	0.4253	3.4024	68.05
Millet	0.4111	3.2888	65.78
Buckwheat	0.3402	2.7216	54.43
Oats	0.2835	2.2680	45.36

SOURCE: Ministry of Food and Agriculture, Agricultural Statistics of Nepal (Nepal: Ministry of Food and Agriculture, 1972).

APPENDIX X

PRODUCTION OF FOOD GRAINS IN THREE ADJOINING STATES

States	Rice	Maize	Wheat	Other	Total Cereals
			(1,000 Metric Tons)		
Bihar					
1964-65	4,913.7	584.4	417.8	--	6,291.7
1965-66	4,462.0	757.2	477.3	--	5,902.1
1966-67	1,645.2	948.7	365.0	--	3,246.9
1967-68	4,731.6	1,129.8	913.5	--	7.343.0
1968-69	5,197.4	1,019.0	1,259.0	--	7,863.7
U.P.					
1964-65	3,323.4	888.3	4,117.9	--	11,556.5
1965-66	2,342.[illegible]	1,121.0	3,754.7	--	10,033.9
1966-67	2,013.[illegible]	1,076.1	4,[illegible]30.3	--	9,867.8
1967-68	3,262.[illegible]	1,134.4	5,[illegible]40.7	--	13,492.9
1968-69	2,922.1	1,338.2	[illegible]6.8	--	13,012.0
West Bengal					
1964-65	5,760.6	38.8	28.0	--	5,853.9
1965-66	4,893.1	42.5	34.0	--	5,010.0
1966-67	4,824.3	39.6	45.5	--	4,956.0
1967-68	5,208.2	45.8	71.1	--	5,374.7
1968-69	6,250.0	39.2	300.0	--	6,654.0

SOURCE: HMG/Nepal, Ministry of Food and Agriculture, Some Useful Information on the Rice Situations in the States of Bihar, U.P., and West Bengal in India. (Kathmandu: HMG, 1971).

APPENDIX XI

CONSUMER PRICE INDEX OF WHEAT FLOUR, NEPAL

Year	Nepal	Kathmandu	E. Tarai	W. Tarai	E. Hills	W. Hills
			(Base Year: 1961/62)			
1961/62	100.00	100.00	100.00	100.00	100.00	100.00
1962/63	84.21	103.33	106.18	87.40	92.06	79.48
1963/64	102.63	115.55	106.18	107.87	103.96	95.72
1964/65	157.01	225.55	157.73	135.43	148.41	178.63
1965/66	197.36	265.55	213.40	159.05	220.63	211.11
1966/67	155.26	198.88	167.01	123.62	116.66	206.83
1967/68	206.14	254.44	205.15	155.11	194.44	265.81
1968/69	189.47	216.66	198.96	133.85	250.79	220.51
1969/70	164.91	214.44	167.01	123.62	196.82	182.05
1970/71	166.67	206.67	167.01	132.62	181.34	173.50

SOURCE: Information from Research Department, Nepal Rastra Bank, Kathmandu, Nepal.

APPENDIX XII

LITERATURE REVIEW ON FACTORS AFFECTING CEREAL GRAIN PRICES IN INDIA AND PAKISTAN

Here some of the works completed in the field of analysis of food grain prices in India and Pakistan are reviewed. J. R. Rao and K. S. Murty's econometric study of rice prices for the post-independence period (1948/60) in India was conducted in order to gain some understanding of the factors affecting farm, wholesale and retail prices.[1] The model is very simple, and the linear single least-squares regression technique is used.

In this study, on determination of the farm harvest price, the influence of output was found to be negligible, and the intensity of demand in terms of the previous year's retail price was found to be important. Per capita availability was found to be insignificant in influencing wholesale price. In explaining retail prices, the coefficients of wholesale prices and per capita real income are found to be significant; but real income's influence was minimal.

The study has very few explanatory variables. Prices of substitutes are not included. This study supplies information on the degree of positive correlations between different prices, but does not contribute to an understanding of factors affecting those prices. The study gives emphasis to marketable surplus rather than output as a supply variable. In their words: "The results are highly tentative because such a simple model cannot adequately describe the complicated situation."[2]

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[1] J. R. Rao and K. S. Murty, "An Econometric Study of Rice Price in India, 1948-60," Indian Economic Journal, Vol. 45 (1964-65), pp. 385-393.

[2] Ibid., p. 383.

R. Thamarajakshi has made a series of studies on food grain prices for India. The model used is comprehensive. One of the studies is on determinants of wheat prices.[1] The study is an econometric study of wholesale price per quintal[2] of wheat for the period 1952/53 to 1967/68. The independent variables are per capita vailability of wheat (S_r), per capita availability of other cereals (S_o), per capita income at current prices (Y_c), per capita income at constant prices (Y_m), per capita money supply (M_s), and money supply deflated by real income (M_y). In total, 10 different models were tried with the linear single least-squares regression technique.

It was concluded that wheat availability was to be increased by 3.2 percent to offset increases in price induced by a 1 percent increase in per capita current income.[3] Demand-induced variables such as income and money supply are important in determining the wheat price in India.

R. Thamaharajakshi's second study, "Cereal Prices in the Indian Economy,"[4] was carried on to explain the rising trend of prices in terms of differential rate of expansion of availability of and

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1 R. Thamarajakshi, "Determinants of Wheat Price," Agricultural Situation in India (Delhi: Ministry of Food, Agriculture, Community Development and Cooperation, May, 1970), pp. 129-136.

2 One quintal = 100 kilograms.

3 The result of the regression analysis of model 2 is as follows:

$$Pt = 70.2836 - 0.8740\ Sk - 0.783\ Sr - 0.4874\ So + 0.2311\ Yc \quad R^2 = 0.9508$$
$$(0.6980) \quad (0.0222) \quad (0.4227) \quad (0.0405)$$

4 R. Thamarajkshi, "Cereal Prices in the Indian Economy," Agricultural Situation in India (Delhi: Directorate of Economics and Statistics, Ministry of Agriculture, August, 1971), pp. 303-305.

demand for different cereals. The period covered in the study is 1952/53 to 1968/69. For each cereal grain, only one model is used.

The main finding is that rice availability is a very important variable in explaining not only its own prices, but the prices of other grains, and the availability of wheat has no significant effect on its own price and other grain prices.

John W. Mellor and Ashok K. Dar's study[1] on food grain prices in India for the period 1949 to 1964 is contributive in two respects. First, it shows that the upward trend in prices is largely associated with the supply of money, and the year-to-year fluctuations in price are caused by fluctuations in production because of weather.

Secondly, the area to which less attention is paid to less developed countries is in the influence of speculative and storage activities of traders and farmers. Mellor and Dar's study shows that farm storage in India is large and has a stabilizing effect on price.

The study points out that:

> The relatively large standard error for the lagged demand-supply variable suggests that farmers' storage decisions are not highly predictable and provide a major source of error in estimating future price levels. Since farmers storage decisions are so important to price determination, it would be useful to study this matter more carefully.[2]

The variables introduced to study the wholesale price of food grains are: money, supply, and the gap between aggregate real demand and supply with a lag of one and two years.

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[1] John W. Millor and Ashok K. Dar, "Determinants and Development Implications of Food Grain Prices in India, 1949-64," Journal of Farm Economics, Vol. 50, No. 4 (1968), pp. 962-974.

[2] Ibid., p. 973.

The results and their implications are highly important in the formulation of policies related to buffer stock, in analysing the relations of agricultural and nonagricultural sectors in overall economic development, and in the assessment of governmental monetary policy. In this study, the possible implications are clearly exposed.

One of the major comprehensive studies on the structure and behaviour of food grain prices in India was carried out by the National Council of Applied Economic Research, New Delhi.[1] The primary objective of the study was to examine the role of prices in production, marketed supply and resource use. With respect to structure and behaviour of prices, a review of trend, seasonal variations and regional variations of rice, wheat, jowar (grain sorghum) and gram wholesale prices for the period 1950 to 1965 were carried out.

The study shows that the movement of prices of various food grains is positively correlated. As India is deficit in food grains, particularly in the most important staple food grains (namely rice), the increase in rice price would have positive effects. As far as other substitute grains such as wheat are concerned, their effect on the price of rice is found to be small either because their share in total food grains production is low, or due to consumers' preference for rice (more than wheat, jowar and corn).

During the period 1950 to 1965, India had three different experiences in the movements of prices. The period 1950 to 1956 observed a downward trend in prices, and the price level dropped by

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[1] NCAER, Structure and Behaviour of Price of Food Grains (New Delhi: National Council of Applied Economic Research, May, 1969).

25 percent. The period 1957 to 1962 was a relatively stable price period. And from 1962 to 1965, prices increased rapidly at an average annual rate of 8 percent.

In that study, the factors affecting prices are analysed. The econometric models used are quite simple. The analysis is done separately for each food grain. However, a study of aggregate price of food grains is not conducted. Specifically, two models were used for each crop: one model having two independent variables, namely per capita availability and total money supply with the public, and the second model used per capita availability and per capita income at current prices.

The results of the study are consistent with some of the studies mentioned above. Rice availability is a significant factor in the determination of rice price, but wheat availability is not found significant in determining wheat prices. The demand factor is more significant than the supply factor.

A.F.A. Husain's study on price and distribution controls in Pakistan gives a review of the measures undertaken to control the price of various commodities such as rice, sugar, wheat, etc. in East Pakistan during the late 1950's.[1] The study showed that the major reason for rise in price was inadequate supply to meet increasing demand. There was instability in prices and the causes were lack of storage facilities and inadequate means of transport.

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[1] A.F.A. Husain, "Price and Distribution Controls in Pakistan," Pakistan Economic Journal, Vol. XI, No. 2 (June, 1961), pp. 17-25.

The author points out that increasing development expenditure and the problem of monetary control are also responsible for the rise in prices. He suggests that price control measures be well associated with monetary and fiscal measures. Another important solution was a crash program in agriculture to increase production.

S. G. Kabir points out that price fluctuation has detrimental effects on farmers' motivation to invest in the intensification of production. The adverse effect is more on farm price than on retail and wholesale price. The argument is that the fall in retail price is thrown back to farmers because the marketing agents have control of the market.[1]

Kabir has followed the conventional approach of blaming retailers and wholesalers for higher prices to consumers and lower prices to farmers. But he has not presented any empirical evidence to show whether those intermediaries receive more than they are supposed to get for their goods and services.

Kabir's opinion is that more cost is involved in retailing than in wholesaling because wholesale business is run on a large scale, hence nonefficient performance. This hypothesis also is not substantiated with empirical findings. So far as control and stabilization measures are concerned, he has recommended a buffer stock operation under the responsibility of an autonomous public corporation; the corporation should establish a close relationship with cooperatives for the collection and distribution of products.

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[1] S. G. Kabir, "A Plan for the Stabilization of Agricultural Prices in East Pakistan," Pakistan Economic Journal, Vol. XII, No. 1 (March, 1962), pp. 79-92.

Rabbini and Repetto's study on factors affecting retail prices of rice in East Pakistan reveals that two factors, namely the per capita availability of total food grains (supply factor) and the level of money supply representing monetary demand, are important.[1] The elasticity of coarse rice prices with respect to per capita availability is -2.92, and the price elasticity with respect to money supply is only 0.47. The period of study is from 1959/60 to 1967/68.

This study shows that the change in money supply required to offset a change in supply is six times as large; this large swing in money supply in order to stabilize rice price may cause greater disruption in other sectors of the economy. It seems that the monetary policy may not have been quite effective in the context of overall economic growth. Therefore, a supply regulation program was recommended.

The study does not introduce income and price of substitutes as the variables. However, per capita availability is the important variable as the food grains sector predominates in the East Pakistan economy. The correlation coefficient between changes in GNP and rice production was found to be 92 percent.

All the above studies relate to the general price level of food grains. The money supply variable is given much emphasis in order to represent the effect of changes in money income. The results of these studies show the great importance of increase supply and its proper management. Similar studies which are essential for planning and programming for the agricultural sector were not available for Nepal.

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[1] A.K.M. Ghulam Rabbani and R. C. Repetto, "Food Grains Availability, Money Supply and the Price Level in East Pakistan: Some Simple Econometrics on Short Term Stabilization Policies," The Pakistan Development Review, Vol. VIII, No. 2 (Sept., 1968), pp. 281-287.

APPENDIX XIII

FACTORS AFFECTING PRICE OF CEREAL GRAINS, NEPAL[1]

No.	Form of Equation		Intercept	I_r	P_n	A_{cn}	Y.	F-Value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	14.313	.0109*	- .0015*	- .0090*	.0047	23.81	95	.101	2.13
		S. Error		(.0029)	(.0004)	(.0040)	(.0010)				
2	Double Log	Coefficient	29.420	.9857*	- 8.5139*	- .7137**	1.5848*	28.4	96	.031	2.67
		S. Error		(.3207)	(2.1691)	(.5718)	(.3363)				

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] I_r = Wholesale price index of rice in India, P_n = population of Nepal in thousands, A_{cn} = per capita availability of cereal grains in Nepal in kilograms, and Y = per capita income in Nepal at current prices.

APPENDIX XIV

FACTORS AFFECTING PRICE OF RICE, NEPAL[1]

No	Form of Equation		Intercept	I_r	MW_n	R_r	P_n	A_{rn}	Y	F-Value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	2.461	.0120*	-.0026	- .0015				11.15	85	.184	1.12
		S. Error		(.0034)	(.0020)	(.0019)							
2	Linear	Coefficient	13.773	.0112*			-.0015*	-.0146**	.0048*	31.23	96	.101	2.58
		S. Error		(.0029)			(.0004)	(.0081)	(.0011)				
3	Double Log	Coefficient	.800	.5216	-.8416	.3004				14.23	88	.048	1.65
		S. Error		(.5504)	(.8631)	(.3310)							
4	Double Log	Coefficient	2.335	.9175*			-6.9677*	- .4793	1.3676*	49.75	98	.024	2.83
		S. Error		(.2624)			(1.6269)	(.3992)	(.2653)				

* Significant at 95 percent level.
** Significant at 90 percent level.

[1] I_r = Wholesale price index of rice in India, MW_n = total production of maize and wheat in Nepal in thousand metric tons, R_r = difference between changes in quantity demanded and availability of rice for domestic use in thousand metric tons, P_n = population in Nepal in thousands, A_{rn} = per capita availability of rice in Nepal in kilograms, and Y = per capita income at current prices.

APPENDIX XV

FACTORS AFFECTING PRICE OF WHEAT FLOUR, NEPAL[1]

No.	Form of Equation		Inter-cept	P_r	A_{wn}	Y	I_f	P_n	W_{pn}	F-Value	R^2 Percent	Standard Error of Estimate	d-Statis-tics
1	Linear	Coefficient	-.489	1.6662*	.0115	.0005	-.0059			13.40	91	.191	2.31
		S. Error		(.5496)	(.0491)	(.0012)	(.0062)						
2	Linear	Coefficient	8.241	1.2080*		0.0035*		-.0010*	.0006	37.79	97	.117	2.80
		S. Error		(.2234)		(.0013)		(.0003)	(.0018)				
3.	Double Log	Coefficient	.167	1.2754*	-0.1775	.0931	-.1168						
		S. Error		(.5734)	(.4020)	(.4917)	(.5916)			14.73	92	.051	2.09
4.	Double Log	Coefficient	18.536	1.0230*		1.1185*		-5.4318*	.0898	32.37	96	.035	2.56
		S. Error		(.2940)		(.5432)		(2.3422)	(.2414)				

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] P_r = price of rice Rs/kg, Nepal, A_{wn} = per capita availability of wheat in kg., Nepal, Y = income per capita in Rs, I_f = wholesale price index of wheat flour, India, P_n = population in Nepal in thousands, W_{pm} = wheat production in thousand metric tons, Nepal.

APPENDIX XVI

FACTORS AFFECTING PRICE OF MAIZE, NEPAL[1]

No	Form of Equation		Intercept	P_r	P_n	M_{pn}	Y	F-value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	2.589	.7587*	-.0003	.0003	.0006	3.78	75	.174	1.50
		S. Error		(.3336)	(.0004)	(.0020)	(.0020)				
2	Double Log	Coefficient	13.678	1.0810**	- 3.8679	.0035	.5640	4.46	78	.076	1.54
		S. Error		(.6519)	(4.1475)	(1.930)	(1.2078)				

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] P_r = Price of rice Rs/kg, Nepal, P_n = population in thousands, Nepal, M_{pn} = Maize production in thousand metric tons, Nepal, Y = Per capita income in Rs, Nepal.

APPENDIX XVII

FACTORS AFFECTING PRICE OF RICE, EASTERN TARAI[1]

No.	Form of Equation		Intercept	I_r	Y	P_{et}	R_{pet}	MW_{et}	F-value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	9.544	.0127*	.0052*	-.0043*	-.0027	-.0005	33.92	98	.083	2.73
		S. Error		(.0026)	(.0012)	(.0009)	(.0039)	(.0040)				
2	Linear	Coefficient	9.902	.0125*	.0053*	-.0044*	-.0032*		52.75	98	.074	2.73
		S. Error		(.0021)	(.0008)	(.0007)	(.0012)					
3	Double Log	Coefficient	13.727	1.1513*	1.5226*	-5.5208	-.1199	-.4298	45.44	98	.023	3.55
		S. Error		(.3130)	(.4100)	(1.1070)	(.3569)	(1.8457)				
4	Double Log	Coefficient	15.221	1.0834*	1.6225*	-5.5772*	-1.0167*		69.01	98	.021	3.63
		S. Error		(.2168)	(.2563)	(.9924)	(.5418)					

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] I_r = wholesale price index of rice in India, Y = per capita income in Nepal at current prices, P_{et} = population of eastern Tarai in thousands, R_{pet} = rice production in eastern Tarai in thousand metric tons, MW_{et} = total production of maize and wheat in eastern Tarai in thousand metric tons.

APPENDIX XVIII

FACTORS AFFECTING WHEAT FLOUR PRICE, EASTERN TARAI[1]

No.	Form of Equation		Intercept	P_{ret}	W_{pet}	Y	P_{et}	I_f	F-value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	5.324	.4004	-.0128*	.0044*	-.0030*	-.0065	21.29	95	0.117	2.91
		S. Error		(.3923)	(.0083)	(.0014)	(.0012)	(.0045)				
2	Linear	Coefficient	-.271	.9580*	-.0138	.0014		-.0008	12.33	91	0.166	2.18
		S. Error		(.4587)	(.0118)	(.0011)		(.0052)				
3	Linear	Coefficient	-.269	.9085*	-.0150**	.0014			19.64	91	0.152	2.15
		S. Error		(.2859)	(.0078)	(.0010)						
4.	Double Log	Coefficient	9.625	.3095	-.1477	1.3625*	-4.2772**	.6873**	22.77	97	0.034	2.93
		S. Error		(.3702)	(.1530)	(.5816)	(2.1603)	(.4093)				
5.	Double Log	Coefficient	-1.430	.7224*	-.3179**	.4260		.3354	17.35	93	0.043	2.16
		S. Error		(.3851)	(.1592)	(.4259)		(.4641)				
6.	Double Log	Coefficient	-1.139	.8834*	-.2455*	.5418			24.95	93	0.041	2.15
		S. Error		(.3014)	(.1188)	(.3786)						

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] P_{ret} = price of rice in eastern Tarai Rs/kg, W_{pet} = wheat production in eastern Tarai, Y = per capita income in Nepal at current prices, P_{et} = population of eastern Tarai in thousands, and I_f = wholesale price index of wheat in India.

APPENDIX XIX

FACTORS AFFECTING PRICE OF RICE, WESTERN TARAI[1]

No.	Form of Equation		Inter-cept	I_r	R_{pwt}	Y	P_{wt}	MW_{wt}	F-value	R^2 per-cent	Standard Error of Estimate	d-Statis-tics
1	Linear	Coefficient	4.097	.0138*	-.0012	.0044*	-.0081*	-.0041**	11.34	99	.052	3.26
		S. Error		(.0019)	(.0011)	(.0005)	(.0012)	(.0024)				
2	Linear	Coefficient	.505	.0041	-.0056*	.0024*		.0017	14.20	92	.157	2.45
		S. Error		(.0035)	(.0025)	(.0010)		(.0068)				
3	Linear	Coefficient	3.531	.0121*	-.0022*	.0044*	-.0073*		10.35	99	.060	2.44
		S. Error		(.0019)	(.0010)	(.0005)	(.0013)					
4	Double Log	Coefficient	6.024	1.7359*	-.0295	1.4380*	-4.518*	-.2720	64.35	99	.024	2.58
		S. Error		(.2611)	(.2849)	(.3353)	(1.1161)	(.3163)				
5	Double Log	Coefficient	-.014	.3428	-.8370*	1.1038*		.1285	18.73	94	.001	2.09
		S. Error		(.4000)	(.4107)	(.4225)		(.6066)				
6	Double Log	Coefficient	-.099	1.2933*	.1779	1.7443*	-4.2173*		84.66	99	.0002	1.97
		S. Error		(.2822)	(.2208)	(.2540)	(1.0321)					

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] I_r = wholesale price index of rice in India, R_{pwt} = rice production in thousand metric tons, Y = per capita income in Nepal at current prices, P_{wt} = population of western Tarai in thousands, and MW_{wt} = total production of maize and wheat in western Tarai in thousand metric tons.

APPENDIX XX

FACTORS AFFECTING WHEAT FLOUR PRICE, WESTERN TARAI[1]

No.	Form of Equation		Inter-cept	P_{rwt}	I_f	Y	P_{wt}	W_{pwt}	F-value	R^2 Per-cent	Standard Error of Estimate	d-Statis-tics
1	Linear	Coefficient	1.132	1.0276**	-.0061	.0014	-.0010	-.0023	6.08	88	.147	2.57
		S. Error		(.6954)	(.0080)	(.0023)	(.0051)	(.0226)				
2	Linear	Coefficient	.647	1.0965*	-.0071	.0010		-.0043	9.40	88	.133	2.60
		S. Error		(.5315)	(.0056)	(.0011)		(.0181)				
3	Linear	Coefficient	.496	.5077**		.0013		-.0229*	10.94	85	.139	2.80
		S. Error		(.2647)		(.0011)		(.0109)				
4	Double Log	Coefficient	1.223	.7523	-.3674	.4640	-.5114*	-.0897	7.91	91	.037	2.64
		S. Error		(.5786)	(.7153)	(.9294)	(2.8000)	(.2440)				
5	Double Log	Coefficient	.383	.8293*	-.4580	.3095		.1196	12.25	91	.033	2.66
		S. Error		(.3558)	(.4627)	(.3458)		(.1627)				
6	Double Log	Coefficient	-.385	.5466*		.2925		-.2409*	16.06	89	.019	2.90
		St Error		(.2118)		(.3448)		(.1067)				

* Significant at 95 percent level.

** Significant at 90 percent level.

1 P_{rwt} = price of rice in western Tarai RS/kg, I_f = wholesale price index of wheat in India, Y = per capita income in Nepal at current prices, P_{wt} = population of western Tarai in thousands, and W_{pwe} = wheat production in western Tarai in thousand metric tons.

APPENDIX XXI

FACTORS AFFECTING PRICE OF RICE, KATHMANDU[1]

No.	Form of Equation		Intercept	P_{wk}	P_k	R_{pk}	MW_k	Y	F-value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	- 6.671	.0989	.0189*	-.0294	-.0003	-.0011	15.74	95	.111	1.52
		S. Error		(.1966)	(.0058)	(.0232)	(.0085)	(.0019)				
2	Linear	Coefficient	- 6.658	.1005	.0188*	-.0300*		-.0011	24.59	95	.099	1.52
		S. Error		(.1712)	(.0051)	(.0138)		(.0017)				
3	Linear	Coefficient	- 6.230		.0177*	-.0347*		-.0002	36.68	95	.094	1.11
		S. Error			(.0045)	(.0106)		(.0008)				
4	Double Log	Coefficient	-12.124	.1557	5.1228*	-.5386	-.0118	-.2807	13.35	94	.034	1.64
		S. Error		(.2692)	(2.4266)	(.6438)	(.2890)	(.9017)				
5	Double Log	Coefficient	-12.025	.1543	5.0784*	-.5595**		-.2677	20.84	94	.030	1.64
		S. Error		(.2390)	(1.9424)	(.3504)		(.7545)				
6	Double Log	Coefficient	-11.469		4.5030*	-.6789*		.1750	30.63	94	.029	1.20
		S. Error			(1.6397)	(.2828)		(.2991)				

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] P_{wk} = price of wheat flour in Kathmandu in Rs/kg, P_k = population of the Kathmandu Valley in thousands, R_{pk} = rice production in the Valley in thousand metric tons, MW_k = total production of maize and wheat in the Valley in thousand metric tons, and Y = per capita income in Nepal at current prices.

APPENDIX XXII

FACTORS AFFECTING PRICE OF WHEAT FLOUR IN KATHMANDU[1]

No.	Form of Equation		Intercept	P_{rk}	P_{mk}	P_k	W_{pk}	Y	F-value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	2.379	.4159	.2321	-.0087	.0400	.0060**	8.68	92	.241	2.69
		S. Error		(.8739)	(.6675)	(.0287)	(.0582)	(.0031)				
2	Linear	Coefficient	-1.031	.2164	.1370		-.0563*	.0053*	15.23	91	.218	2.43
		S. Error		(.5208)	(.5125)		(.0200)	(.0016)				
3	Double Log	Coefficient	11.232	.7266	.0359	-6.6634	-.1047	2.5512*	11.64	94	.062	2.81
		S. Error		(.6899)	(.3482)	(5.8771)	(.4070)	(.9561)				
4	Double Log	Coefficient	-4.109	.4304	.0050		-.4990*	1.7047*	13.47	92	.064	1.96
		S. Error		(.6565)	(.3569)		(.2174)	(.6140)				

* Significant at 95 percent level.
** Significant at 90 percent level.

[1] P_{rk} = price of rice Rs/kg, Kathmandu, P_{mk} = price of maize Rs/kg, Kathmandu, P_k = population in thousands, Kathmandu, W_{pk} = wheat production in thousand metric tons, Kathmandu, Y = income per capita in Rs at current prices.

APPENDIX XXIII

FACTORS AFFECTING PRICE OF RICE, EASTERN HILLS[1]

No.	Form of Equation		Intercept	P_{ret}	P_{eh}	R_{peh}	MW_{eh}	Y	F-value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	- 5.646	-.6625*	.0032	.0065	-.0021**	.0001	22.84	97	.126	2.74
		S. Error		(.2391)	(.0029)	(.0076)	(.0011)	(.0014)				
2	Linear	Coefficient	- 5.215	.6512*	.0029*	.0065	-.0021*		35.60	97	.113	2.72
		S. Error		(.1881)	(.0013)	(.0068)	(.0009)					
3	Linear	Coefficient	1.247	.3501*		-.0039	-.0028*		27.72	93	.145	1.89
		S. Error		(.1686)		(.0063)	(.0012)					
4	Double Log	Coefficient	-12.199	.6574*	3.5896	.4240	-.2203**	.0531	29.38	97	.032	2.59
		S. Error		(.2563)	(3.3001)	(.3596)	(.1291)	(.5080)				
5	Double Log	Coefficient	-12.991	.6752*	3.8691*	.4274	-.2177**		45.78	97	.029	2.58
		S. Error		(.1716)	(1.7324)	(.2307)	(.1135)					
6	Double Log	Coefficient	.888	.9768		-.0917	-.2789**		35.67	95	.038	1.84
		S. Error		(.1367)		(.2850)	(.1421)					

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] P_{ret} = price of rice in eastern Tarai in Rs/kg, P_{eh} = population of eastern Hills in thousands, R_{peh} = rice production in eastern Hills in thousand metric tons, MW_{eh} = total production of maize and wheat in eastern Hills in thousand metric tons, and Y = per capita income in Nepal at current prices.

APPENDIX XXIV

FACTORS AFFECTING WHEAT FLOUR PRICE, EASTERN HILLS[1]

No.	Form of Equation		Inter-cept	P_{reh}	P_{wet}	P_{eh}	W_{peh}	Y	F-value	R^2 Per-cent	Standard Error of Estimate	d-Statis-tics
1	Linear	Coefficient	20.895	.6324	.0115	-.0127	.0313	.0084	6.02	88	.363	2.22
		S. Error		(1.1933)	(1.1415)	(.0146)	(.0293)	(.0067)				
2	Linear	Coefficient	-1.226	-.1843	.8341		.0304	.0029	7.71	86	.354	2.50
		S. Error		(.7178)	(.6231)		(.0286)	(.0020)				
3	Linear	Coefficient	-0.698	.4831	1.0614**		.0165		8.07	80	.386	1.63
		S. Error		(.6011)	(.6568)		(.0294)					
4	Double Log	Coefficient	4.111	-.2441	.5032	-2.3531	.1069	1.3644	5.42	87	.085	2.35
		S. Error		(.7454)	(.8169)	(11.0865)	(.1665)	(1.8079)				
5	Double Log	Coefficient	-2.720	-.3185	.6284		.1123	1.0183	8.36	87	.076	2.46
		S. Error		(.5918)	(.5084)		(.1480)	(.7025)				
6	Double Log	Coefficient	.043	.2362	.9925**		.0251		8.83	82	.083	1.66
		S. Error		(.4911)	(.5071)		(.1471)					

* Significant at 95 percent level.

** Significant at 90 percent level.

[1] P_{reh} = price of rice in eastern Hills in Rs/kg, P_{wet} = price of wheat flour in eastern Tarai in Rs/kg, P_{eh} = population of eastern Hills in thousands, W_{peh} = wheat production in eastern Hills in thousand metric tons, and Y = per capita income in Nepal at current prices.

APPENDIX XXV

FACTORS AFFECTING PRICE OF RICE, WESTERN HILLS[1]

No.	Form of Equation		Intercept	P_{rwt}	R_{pwh}	MW_h	Y	P_{wh}	F-value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	1.324	1.3681*	.0064*	-.0076*	-.0011	.0004	38.09	98	.086	3.03
		S. Error		(.1621)	(.0024)	(.0029)	(.0010)	(.0011)				
2	Linear	Coefficient	5.356	1.2647*	.0059*	-.0076*		-.0008**	43.78	97	.089	2.79
		S. Error		(.1417)	(.0024)	(.0030)		(.0005)				
3	Linear	Coefficient	2.686	1.3537*	.0062*	-.0076*	-.0008*		57.56	98	.078	3.10
		S. Error		(.1429)	(.0021)	(.0030)	(.0004)					
4	Double Log	Coefficient	.361	.9887*	.4060*	1.3210*	-.4615**	1.0126	54.71	99	.017	3.13
		S. Error		(.1227)	(.1415)	(.4969)	(.2811)	(1.7641)				
5	Double Log	Coefficient	8.102	.8330*	.3500*	1.1688		-1.5742**	50.57	98	.019	2.42
		S. Error		(.0913)	(.1590)	(.5649)		(.9176)				
6	Double Log	Coefficient	3.487	.9555*	.3892*	1.2649*	-.3173		78.88	98	.016	3.06
		S. Error		(.1008)	(.1288)	(.4534)	(.1176)					

* Significant at 95 percent level.

** Significant at 90 percent level.

1 P_{rwt} = price of rice in western Tarai in Rs/kg, R_{pwh} = rice production in western Hills in thousand metric tons, MW_{wh} = total production of maize and wheat in western Hills in thousand metric tons, Y = per capita income in Nepal at current prices, and P_{wh} = population of western Hills in thousands.

APPENDIX XXVI

FACTORS AFFECTING WHEAT FLOUR PRICE, WESTERN HILLS[1]

No.	Form of Equation		Intercept	P_{rwh}	P_{wwt}	W_{pwh}	P_{wh}	Y	F-value	R^2 Percent	Standard Error of Estimate	d-Statistics
1	Linear	Coefficient	- 2.875	1.5166*	.4945	.0171*		-.0005	35.80	97	.176	3.47
		S. Error		(.4155)	(.5131)	(.0072)		(.0006)				
2	Linear	Coefficient	- 0.798	1.5632*	.3750	.0162*	-.0006		34.84	97	.178	3.44
		S. Error		(.4654)	(.5455)	(.0070)	(.0008)					
3	Linear	Coefficient	-11.196	1.2575**	.9776	.0196*	.0023	-.0024	24.02	97	.193	3.46
		S. Error		(.7515)	(1.2496)	(.0098)	(.0054)	(.0044)				
4	Double Log	Coefficient	- 1.391	1.3815*	.5574	.6399**		-.0246	28.58	96	.049	3.38
		S. Error		(.5804)	(.5703)	(.3927)		(.2728)				
5	Double Log	Coefficient	- .686	1.3955*	.5366	.6359**	-.2136		28.59	96	.049	3.38
		S. Error		(.6338)	(.6098)	(.3784)	(2.0496)					
6	Double Log	Coefficient	.853	1.4155**	.4914	.6225	-.6843	.0642	18.31	96	.055	3.37
		S. Error		(.8297)	(1.1879)	(.5127)	(10.3934)	(1.3829)				

* Significant at 95 percent level.

** Significant at 90 percent level.

1 P_{rwh} = price of rice in western Hills in Rs/kg, P_{wwt} = price of wheat flour in western Tarai in Rs/kg, W_{pwh} = wheat production in western Hills in thousand metric tons, P_{wh} = population of western Hills in thousands, and Y = per capita income in Nepal at current prices.